Donor funding and crowding out of public spending: Evidence from low and middle-income countries

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By

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ABSTRACT

In many low-resource settings agricultural output and public spending on agriculture are in decline, raising questions about the effectiveness of agricultural aid. To understand why these trends are occurring, we examined factors that affect the share of government spending on agriculture. Using a sample of 66 low- and middle-income countries from 1996-2010 we use dynamic panel regression models to explore: (1) the impact of agricultural aid on public expenditure to agriculture, and (2) the impact of aid on domestic resource mobilisation, which indirectly affects public expenditures. Our results provide evidence of a strong substitution effect, especially in low-income countries, suggesting aid to agriculture is treated as fungible. We also found evidence that aid loans resulted in higher tax revenues, while aid grants decreased tax effort, which may account for decreasing public investment in agriculture. To improve aid effectiveness, donors need to work with recipients to understand country needs and the fiscal environment of the receiving government.

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1 INTRODUCTION

1.1 Research Area

Agriculture remains the single most important sector for ensuring socio-economic development in a majority of low- and middle-income countries. Over and above the significance of agriculture in addressing food insecurity, agriculture is a major contributor to the national income of low- and middle-income countries. In particular, agriculture accounts for 20-60% of GDP , employs up to 65% of the labour force in low- and middle-income countries and as a result provides livelihood for approximately 2.6 billion people globally (UNCTAD, 2010). Therefore, a focus on agriculture driven development strategies is imperative in the socio-economic development of low and middle-income countries (DFID, 2004).

Expenditure in agriculture is considered an important public instrument for extracting the cross-sectoral benefits of an investment in agriculture (Akroy & Smith, 2007). However, over the last three decades the public expenditures to agriculture have on average decreased, with agriculture as a share of total public expenditures decreasing from 11% in 1980 to 7% in 2002 (Islam, 2011). Decreasing public commitment to agriculture has been argued to be the cause of the reduction in agricultural production which has subsequently threatened global food security (Mogues et al., 2012). For example, between 1996 and 2010, the number of people suffering from chronic hunger increased by about 13% to over one billion and may be expected to increase further based on expected population increases (UNCTAD, 2010).

Looking forward, based on current trends, it is estimated that developing countries require an additional US$9.2 trillion of agriculture investment to meet projected demand for agricultural products by 2050 (Schmidhuber, Bruinsma & Boedeker, 2009). In light of the immensity of required public expenditure to agriculture, donors have refocused their commitment to agriculture. For instance, bilateral aid to agriculture increased on average by 13% annually between 2003 and 2008 (DAC, 2010). However, donors have increasingly questioned the effectiveness of aid to agriculture. For instance, despite an increase aid to agriculture of 74% between 2000 and 2008 the recent world food crises occurred in late 2008 (Coppard, 2010). More specifically, donors have become increasingly concerned with how recipient governments mediate the inflow of aid through its fiscal behaviour. These concerns have

traditionally centred on fungibility, the potential for recipient governments to use aid received for purposes not intended by donors. The potential for governments to treat agricultural aid as fungible reduces much needed investment into agriculture therefore undermining the development impact of agricultural aid. This is especially a concern for countries in which donor funding is a sizable proportion of total agricultural spending (World Bank, 1998).

Given the importance of agricultural aid in developing countries, this paper seeks to investigate the impact of these flows on government expenditure and ultimately provides policy recommendations on how aid to agriculture should be employed and managed.

1.2 Problem Statement

One of the main mediums through which aid influences aid outcomes is through its increase of recipient public expenditures. However previous studies have found that the additionality of aid can be undermined by the potential for aid recipients to treat aid as fungible. For sectors such as agriculture that are in desperate need of additional funding this may lead to continued under investment in the sector. These findings have subsequently influenced donor aid policies on how to disburse as well as evaluate development assistance. In order to increase aid effectiveness, donors shy away from allocating funds toward countries that have evidence of aid fungibility. Instead, donors prefer to give aid to countries with good governance, as they argue such countries are less likely to divert aid toward uses not intended by governments (Pack & Pack, 1993; World Bank, 1998).

However, Pettersson (2007) argues that policy recommendations should rather consider how fungible funds are used, and whether or not fungible funds are more productive than non-fungible funds. He argues that fungibility is not necessarily a precursor to a government having bad policies, as he found a positive correlation between sound economic policies and aid fungibility. These findings suggest measures of fungibility are unable to discriminate between governments with good and those with bad policies. In addition, (Mcgillivray & Morrissey, 2000, 2001) point out that the focus on fungibility distracts from the more fundamental issue of how aid impacts on fiscal aggregates. As such, the authors advocate for the use of fiscal response studies to examine the broader fiscal impacts of aid especially on governments own revenue raising efforts, more specifically on tax and borrowing. This is due to rising concerns that increasing shares of aid in government income may have actually resulted distorting

incentives for governments to in domestic resource mobilisation(Gupta et al., 2003). This may have important implication for the agriculture sector, which is dependent on both aid as well as tax revenue raised in other sectors. This is because the agriculture sector in developing countries cannot directly levy tax in the sector given the high portion of poor smallholder farmers.

The link between aid to agriculture and public expenditure may not be simply fixed by employing policy recommendations that advocate discriminating against disbursing aid to countries that are likely to treat aid as fungible. White and Lensink (1998) echoes this sentiment noting that this policy of selectivity, may lead to potential beneficiaries of agricultural aid not receiving aid on account of donors pre-emptively assuming that they would treat aid as fungible. It may be that aid fungibility may rather be symptomatic of other issues such as the misalignment of donor and recipient preferences. In addition, aid inflows into aid dependent governments may crowd out revenue raising efforts, which may further undermine the additionality of agricultural aid on agricultural public expenditure.

1.3 Purpose and Significance of the Research

To our knowledge there have been few cross country studies that have specifically investigated the impact of aid on the agriculture sector. In particular, we identified two gaps in the aid fungibility and fiscal response literature. First, in his cross country study (fifty seven countries) of the influence of governance on fungibility Pettersson (2007) did not analyse the fungibility of aid to agriculture in isolation but rather aggregated agricultural aid with other sectors including energy, and transportation. Second, within fiscal response studies no study had specifically analysed the fiscal effects of aid on a subset of aid dependent developing countries in which agriculture is a significant portion of the economy.

It is against this backdrop that this study undertook a panel analysis of a sample of developing countries to evaluate the incidence and the influence of quality of governance on fungibility in the agriculture sector. In addition to assessing the impact of total aid on tax revenue on sample of largely agrarian based developing countries. The results of the study aimed to provide additional understanding into the impact of aid both at the sectoral and national level on agricultural expenditures and in so doing recommend possible policies that would increase the additionally of agricultural aid.

1.4 Research Questions and Scope

This study aimed to conduct an empirical analysis of the impact of aid (total and agricultural) on agricultural public expenditures, by answering the following research question:

1. To what extent is aid to the agricultural sector fungible in low and middle-income countries (LMIC)?
2. Are LMICs with poor governance more likely to have fungible aid in the agriculture sector?
3. Does aid lead to an increase in tax revenues in LMICs?

2 LITERATURE REVIEW

2.1 An overview of the Concept of Agricultural Public Expenditure

For the purposes of this paper, agricultural public expenditures refers to government spending on items classified under the Classification of Functions of Government (COFOG) developed by the Organization for Economic Co-operation and Development (OECD). More specifically, agricultural public expenditures or public expenditures to agriculture refer to expenditure to core areas of government functions relevant to the agriculture sector. These include "agriculture" (crops and livestock), "forestry" (forest crops and timber), and "fishing" (fishing and hunting for commercial and sport purposes) (OECD, 2011). Please see Appendix A for more detailed descriptions of public agricultural expenditures included under the COFOG.

The fundamental rationale for public expenditure in the agricultural sector rests firmly on addressing market failures and increasing the overall economic welfare in the sector. Mogues et al. (2012) argue that market failures in the agriculture sector are ubiquitous in developing countries given the capital goods needed in the sector are characterised by non-rivalry and excludability rendering them public goods. This is to say, capital needed in the sector requires high investments in research and technology in which investors cannot restrict the consumption of these goods and as such cannot derive compensation from market participants that benefit from the investment. In developing countries especially where the enforceability of intellectual property rights is weak, private investors are unable to protect their intellectual property e.g. patents and therefore are unable to fully reap the reward of their investments (Watal, 1999; Spielman & Cavalieri, 2010). In light of this, the private sector in developing countries shies away from agricultural investments for which public investment is then needed to develop the sector. In addition to efficiency concerns, public expenditures in the agriculture sector especially in developing countries are needed to improve the welfare of farmers who are largely poorest of the population and rely on substance smallholder farming as a means of survival (Akroy & Smith, 2007; Mogues, 2012). Though various mechanisms such direct cash transfers, producer cost subsidies, investments in improving the productivity of farmer or public service provision, government expenditures are needed to develop the agriculture sector which is currently at the mercy of poor smallholder farmers and a lack of private sector investment.

2.1.1 Trends of Public Expenditure to Agriculture (1980-2010)

Despite the importance of public expenditure to the agriculture sectors, numerous studies have found that over the last three decades public expenditure in developing countries has increased(Fan & Rao, 2003; Akroy & Smith, 2007; Fan, Omilola & Lambert, 2009; Mogues et al., 2012). For instance, in their study of forty four developing countries Mogues et al., (2012) found that public expenditure increased six fold from $ 821 billion in 1980 to $ 4 932 billion in 2007.Similarly, the authors found that the ratio of public spending relative the size of the economy (as a percentage of GDP) increased from 17% in 1980 to 20% in 2007.

In line with the observed increases in public expenditures, Mogues et al., (2012) found that between 1980 and 2007 on average public expenditure in agriculture increased by 6.1 % annually. In addition, the authors found that per capita public expenditure in agriculture more than doubled over the period, having increased from $20 in 1980 to $44 in 2007. However, Breisinger & Fan (2011) argue that if one observes the relative share of agriculture in total public expenditure then actually public expenditures to agriculture has decreased over time. For example, the authors found that despite real increases in public expenditures in East Asia and the Pacific, the share of agriculture in public expenditure decreased from 10% in 1980 to 6.1% in 2007.This view is also supported by Fan & Saurkar (2008) who found in a study of forty four developing countries that the share of public expenditure as proportion of total public spending declined from over 11% in 1980 to under 7% in 2002. Breisinger & Fan (2011) further argue that an even more insightful measure of public fiscal support of is agriculture expenditure intensity, which measures public agricultural expenditure relative to the size of the sector in the economy (agricultural GDP). The authors found that regions with the highest food security concerns had the lowest observed levels of agricultural expenditure intensity as compared to other developing regions. In particular, Breisinger & Fan (2011) found that in 2007, agricultural expenditure intensity in South Asia and sub-Saharan Africa was only 2.8% and 3.3% respectively, which was a third of the agricultural expenditure intensity observed in East Asia and the Pacific, Europe and Central Asia and Latin America and the Caribbean. In line with these findings, Fan & Saurkar (2008) also found in their cross-country study albeit using a bigger sample (70 countries) that the agricultural expenditure intensity in 2007 was less than 10 % in South Asia and sub-Saharan Africa, which is half the agricultural expenditure intensity observed in developed countries.

Some authors have argued that the decline in agriculture public expenditure in developing countries is a legacy of the post-independence focus on industrialization which led to under investments in agriculture (Fan & Saurkar, 2008; Breisinger & Fan, 2011; Mogues, 2012; Mogues et al., 2012). This may have been further exasperated by the structural adjustment programs introduced in the 1980s which saw the international community advocating for developing countries to induced national budget cuts which negatively impacted public expenditures including in the agricultural sector (Fan & Rao, 2003). Alternatively, the decline in public expenditures may also signal a shift in government priorities and even possibly shifts in the economic structures of governments, which can be seen in the increase in the share of other sectors in total expenditures. For example, (Fan & Saurkar, 2008) found that in spite of the decreasing share of agriculture in total expenditures, spending to education increased in sub-Saharan Africa , Latin America, and Asia by 2%, 4% and 2% respectively. However, there may be some inconsistencies with this argument given that the agriculture sector still accounts for a significant portion of developing country economic sector. This can be seen for instance in sub-Saharan Africa where agriculture output was found to contribute approximately 30% of total GDP in 2007.

Another increasingly emerging school of thought in the literature is that development assistance provided to developing countries may adversely impact the incentives of recipients to increasing public expenditures. This is especially in light of the fact that despite developing countries being significant recipients of foreign aid since the 1970s, a number of sectors such as agriculture have experienced declining public expenditures. For example during the mid- to late-1990s aid inflows were found to account for half of all public expenditures in low-income countries (World Bank, 2001). Even more so, countries that are recovering from conflicts have even higher ratios such as Liberia which had development assistance contribute 78 % to its gross national income in 2008 (World Bank, 2011).

In the proceeding section we aim to explore this line of reasoning in more detail by reviewing the findings of past studies that have aimed to investigate the impact of development assistance flows on public expenditures in developing countries. We first begin with an overview of the concept of aid, followed by review of observed trends of agriculture aid and finally present findings of previous authors on how governments mediate inflows of aid.

2.2 Overview of Official Aid to Agriculture

2.2.1 The Concept of Aid and Aid to Agriculture

There currently exists ambiguity over the definition of 'aid', development assistance that is provided to recipient governments from foreign donors. This ambiguity largely stems from the lack of consensus on what kinds of foreign transfer of resources should be included within the definition of aid. For example some definitions vary in their inclusions of line items such as military assistance, emergency humanitarian relief and soft loans disbursed to low-income countries (Lancaster, 2000). One standard definition of aid which is used both in literature as well by development institutions, is the definition offered by the Development Assistance Corporation (DAC) the development arm of the Organisation for Economic Development and Corporation (OECD).

DAC refers to aid as Official Development Assistance (ODA) when a donor government or multi lateral institution disburses financial flows to eligible countries on the DAC's list of ODA recipients or multilateral development institutions (OECD, 2008a). Drawing from United Nations (UN) and the World Bank country classifications, the list of recipient countries consists of least developed countries (LDCs), low middle-income countries (LMICs), upper-middle-income countries (UMICs) and high-income countries (HICs). LDC's refer to countries that in 2013 their Gross National Income (GNI) per capita was less than $816. LMICs, UMICs, and HICs refer to countries whose GNI in 2010 was in between the specified income bands of, $0 -$ 1 005; $1 006-$3 975: and $3 976-$12 275 respectively. As it currently stands, there are 147 countries that are eligible for ODA which are predominantly found in Africa, Asia and Latin America. DAC further qualifies that for ODA to be valid it must fulfil three further requirements namely,

i. ODA must be provided by official agencies which includes state governments or their associated executive agencies;
ii. ODA must be disbursed with the main objective of promoting economic and welfare development in developing countries (referred to as country eligible for ODA)
iii. Each ODA transaction must be concessional in nature and consist of a minimum of 25% grant funding.

DAC aggregates and reports aid flows at activity levels using their Creditor Reporting System. DAC defines aid to agriculture strictly include all aid flows disbursed toward the subsectors of "agriculture", "forestry" and "fishing" collectively categorised under AFF (Agriculture, Fishing and Forestry) (DAC, 2010) . The full definition of each AFF subsector is provided in Appendix B. The DAC definition of aid to agriculture excludes aid flows that may be argued to effect food security such as rural development and emergency food aid, which may distort perception of trends of aid flows toward food security / agriculture (DAC, 2010)- an issue that is explained further in the proceeding section.

For the purposes of this paper 'aid to agriculture' or 'agricultural aid' will refer to the DAC definition of aid. In addition, "aid" will refer to the official definition of aid endorsed by DAC whilst the term "developing countries" will refer to countries eligible for ODA.

2.2.2 Trend of Official Aid Flows (ODA) to agriculture (1980-2012)

According to Lowder & Carisma (2011), although total aid increased nearly 6 fold from 1973 to 140 billion USD in 2009, the share of agriculture as a portion of total aid decreased from 1980 to the mid to late 2000s. Qualifying this point is the findings offered by Islam, (2011) that aid to agriculture as a proportion of total aid continuously decreased from a peak of 23 % between1979-1981 to 5.5 % during 2003-2005. The declining trend of agricultural aid has been largely attributed to the shifting priorities of donors over time and emergence of new claimants to development assistance. Firstly, aid was found to be increasingly channelled toward social infrastructure where aid to education and health increasing from 9% in 1980 to 33% in 2002 (Arnold, Morrision & Bezemer, 2004). This may be due to the donors increasing investments in sectors in which there is a direct association of aid investment and development outcomes especially in the short term. Social infrastructure for instance may potentially reap much quicker development outcomes in the present such as increasing basic health and education. In contrast, developmental outcomes from agricultural aid are predominately achieved in the long run e.g. research and development (Mogues et al., 2012). Secondly, the competition for agricultural aid has intensified with the emergence of new development assistance areas, more specifically, humanitarian aid due to unforeseen and debt relief debt burdened poor countries. For example, the share of debt relief in total aid commitments more than doubled since 1980, while shares of emergency assistance increased to 6.5% from a previous low of 0.6% in 1980 (Arnold, Morrision & Bezemer, 2004).

There is largely consensus in the literature that from the mid to late 2000s the declining trend of agricultural aid was significantly reversed. More specifically, aid to agriculture in absolute terms (2009 constant US$) doubled to almost $8 billion in 2009 from the mid-2000s, therefore increasing ODA to agriculture as a share of total ODA from 4 percent in mid-2000s to 6 % in 2009 (Breisinger & Fan, 2011). The recent increase in agricultural aid has been largely attributed to the response of donors to the global food crises of 2007/8 that led to over 1 billion people suffering from extreme food insecurity and poverty (Benin, 2014).

The substantial increase in aid to agriculture has come at a time in which the concept of 'additionality' is increasingly being included in aid effectiveness paradigms. This is inline with aid effectiveness literature which asserts that one of the main impact channels of development assistance on the wider economy is its contribution to public development expenditures (Doucouliagos & Paldam, 2008, 2009)**.** This sentiment can be seen in recent multi national agreements such as the Paris Declaration in 2005, that emphasized amongst that aid should result in increased efforts to mobilise domestic resources (OECD, 2008b). Therefore, aid is at minimum expected to result in an increase in public expenditure in sectors or projects by the amount of aid disbursed by donors and in accordance to donor preferences. However, aid may distort the incentives of government and unintentionally produce a series of macroeconomic effects over and above those expected by donors. For example, aid may finance non-developmental expenditures or disincentive recipient governments from revenue raising or debt reduction efforts.

Within aid effectiveness literature, studies focusing on the fiscal impact of aid can be divided into two distinct subcategories. The first is, aid fungibility literature which focuses on whether recipient governments spend aid as intended by donors. Whilst the second, fiscal response literature concentrates on how aid inflows impacts various public financing sources and expenditures such as borrowings and tax revenues.

2.3 Aid Fungibility

2.3.1 The Theory of Fiscal Response of Aid

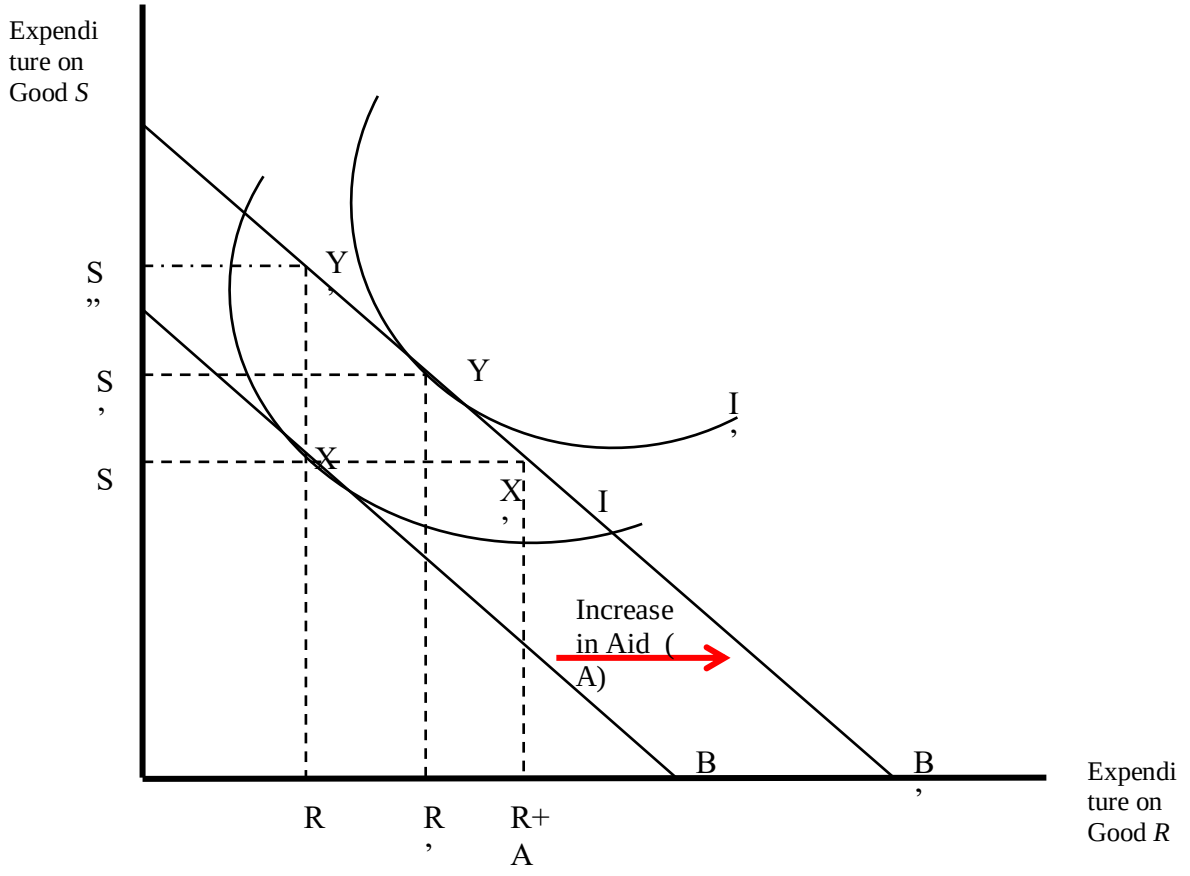
Aid is fungible when recipient governments intentionally divert ODA disbursed from donors toward uses other than those intended by donors (Pack & Pack, 1993; Feyzioglu, Swaroop & Zhu, 1998; World Bank, 1998; Mcgillivray & Morrissey, 2001; Pettersson, 2007; Farag et al., 2009; Marc, 2012). Specifically, aid is fungible if it is perceived as additional revenue by recipient governments which they can use at their own will (Khilji & Zampelli, 1994). As such, the major concern of aid fungibility stems from debate on whether aid disbursed to a recipient government can be used as additional income which the recipient government can freely utilize in accordance to their preferences. It is argued that when aid is fungible the development impact of aid is undermined given that recipient government may divert aid toward consumption of non-development expenditures which may be less productive, for example on defence expenditures (Pettersson, 2007). Given that aid comprises a large component of total government revenue in most developing countries today, fungibility is increasingly influencing aid policy recommendations on how and to whom aid should be disbursed especially (Mcgillivray & Morrissey, 2000).

Previous authors have further broken down the concept of fungibility to account for the varying degrees of fungibility, where aid can be either be fully, partially or non fungible when either all or a portion of aid is diverted toward other uses.

Assuming that a recipient government only spends on two activities, R and S, Mcgillivray & Morrissey (2000) illustrate the different degrees of fungibility as provided in Figure 1a. Prior to receiving aid, a government would allocate expenditures between activities R and S at point X. X is the point at which budget line B and indifference curve I meet. Indifference curve I represents government preferences on expenditure allocation between R and S , whereby increased proportion of expenditure on R is represented by movements downward along the curve , whilst increased expenditure on S is represented by upward along the curve. Therefore, point X as asserted by Mcgillivray & Morrissey (2000) represent, ‘ the optimum, maximising government utility subject to a budget constraint’. Suppose a donor disburses aid amounting to A to a government with the intention that it be used on R however aid is disbursed to the central budget of the country therefore the total budget increases by A, represented by an outward shift

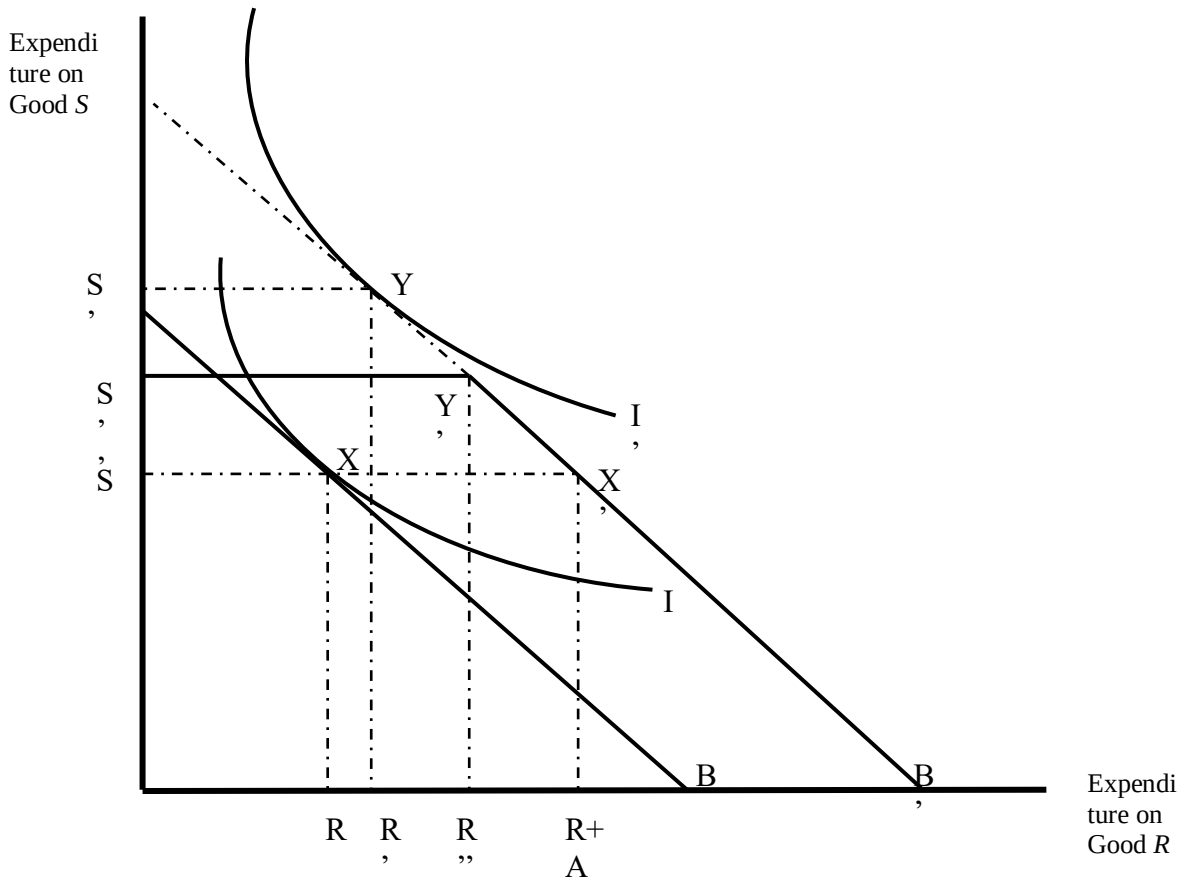
of the budget line to B'. Given that aid was disbursed to the central budget, government sees aid as additional income to the budget which it will be used in accordance to its preference. Therefore, although the donor expected the total budget for R to increase by the full amount of aid at point X'(R+A), the government maximises its utility at Y, where it allocates A to both R and S, with spending on R increasing by R' not R+ A. Therefore the preferences of the recipient government determine the level of fungibility, whereby for any given set of indifference curve the new optimum allocation would at any point along B'. Full fungibility is therefore whereby there is a total misalignment of recipient government preferences from those of donors and all aid is diverted to other uses, in this case all aid received is spent on S, such that pre-aid optimum allocation shifts from point X to point Y'. Contrastingly, aid is non fungible when government and donor priorities fully align resulting in aid being used for its intended purposes, which in Figure 1 is whereby the government uses all aid on R and the optimal allocation of expenditure would be at X' , as intended by donors).

Figure 1: Full Fungibility



In the case of partial fungibility, as depicted in Figure 1b , the donor does restrict the use of aid by trying to tie it to a particular project or component of the total budget e.g. agriculture. The restriction of aid to earmarked results in only a portion of aid being fungible, as illustrated in Figure 2 by truncating the budget line B' at Y', therefore limiting the recipients to allocating to S'' to S and R'' to R. This prevents the recipient government from its optimum expenditure allocation at of point Y which would mean expenditure on R is more aligned to donor priorities at R'' instead of R'. Although this allocation is less than the optimal when aid is non fungible at X', it more favourable than Y' in figure 1 where aid is fully fungible i.e. only a portion of the aid is fungible.

Figure 2: Partial Fungibility



2.3.2 Empirical Findings of Aid Fungibility

Previous research has studied fungibility mainly through two channels, at the macro (aggregate) and meso (sector) level (Farag et al., 2009). At the macro level, aid is fungible when each unit of aid results in a less than proportionate increase in total public expenditure, with aid being diverted to other uses such as private consumption and non-development expenditures etc. At the meso level, aid is fungible when aid disbursed for one sector is used in another sector or for uses not intended by donors e.g. aid for education is diverted toward health expenditures or private consumption.

At the macro level, cross-country studies have failed to reach a consensus on the levels of aid fungibility experienced in developing countries. For example, in a cross sectional study of fourteen countries, Feyzioglu, Swaroop & Zhu (1998)found that aid disbursed from 1970 to 1990 was not fungible. However within the same paper, using an extended sample size of thirty eight countries they found ODA over the same period was partially fungible, with a dollar of aid received resulting in an increase of $0.33 in total government spending. Additionally, Chatterjee, Giuliano & Kaya, (2007) study of 67 countries over the period of 1972 to 2000, found that about $0.70 of every dollar of foreign aid is fungible. The disparity of cross country results may be due to indications that fungibility may be country specific. To illustrate, aid was found to be fully fungible in India (Swaroop, Jha & Sunil, 2000) and Dominican Republic (Pack & Pack, 1993), partially fungible in Sri Lanka (Pack & Pack, 1998) and not fungible in Indonesia (Pack & Pack, 1990).

Similar to aggregate fungibility studies, at the sectoral level, aid fungibility studies have also yielded conflicting results. For instance, within the health sector, Farag et al. (2009)found evidence of partial fungibility of Development Assistance to Health (DAH) in low-income countries, with a $1.00 increase in DAH resulting in a reduction in government public health expenditures of $0.27. The authors point out that this is especially detrimental given their findings that low-income countries had on average low public health expenditures of $24 per capita. By comparison, Lu et al. (2010) found higher levels of partial fungibility whereby every $1.00 increase in DAH given to low-income countries resulted in a decrease in public expenditure to health of $0.32. However, it may be argued that the variance in results may be

due to the use of different sample sizes with Farag et al. (2009) using 65 countries whilst used Lu et al. (2010) 46 countries.

There appears to be relatively few studies that have aimed to assess the levels of sectoral fungibility in the agriculture sector. The few studies that have focused on agriculture, have yielded mixed results with a wide spectrum of evidence ranging from agricultural aid being fully, partially and non fungible. For example using panel data from 1971 to 1995 a cross-country study of 18 Sub-Saharan African countries found aid to agriculture fully fungible (Devarajan, Rajkumar & Swaroop, 1999). Similarly, looking at a larger data set of 38 developing countries, Feyzioglu, Swaroop & Zhu (1998) found aid to agriculture from 1971 through 1990 to also be fully fungible. Contrastingly, Gebrehanna (2007) found in a study of 9 sub-Saharan Africa countries that aid to agriculture between 1980-2003 agriculture was only partially fungible with a $1 increase in aid to agriculture resulting in a decrease in public expenditure in the sector by $ 0.29 cents.

The variation of study results makes it difficult to generalise any conclusion on the extent of fungibility in the agriculture sector. Perhaps, the variation in results may indicate that fungibility is a unique phenomenon which is highly dependent on the country context. This can be seen in the mixed results of individual country studies. For example, in an earlier study of Indonesia Pack & Pack (1990) found no evidence of fungibility of aid to agriculture whilst in their later study of the Domican Republic (Pack & Pack, 1993) the authors found that for every 33 cents of aid intended for agriculture, agricultural public expenditures increase by only 1.5 cents.

The disparity of evidence in aid fungibility studies has also been accompanied with a mix of study conclusions as to what factors are more likely to lead to the existence of fungibility.

Within the literature there have been suggestions that the potential for agricultural aid to be fungible may be minimised when monitoring of aid is increased. For example, in an earlier study Pack & Pack (1998) assert that the amount of aid provided by a donor influenced the level of fungibility. This is to say, Pack & Pack (1998) argue that the larger the contribution of aid to a governments total expenditure the more likely donors are able to monitor changes in public expenditures therefore incentivise recipient governments to increase their development expenditures and reduces aid fungibility. In qualifying this point, Pack & Pack (1998)

compared results of their early studies of the Dominican Republic and Indonesia. Although ODA in Dominican Republic accounted for a relatively smaller proportion of public expenditure than in Indonesia at 8% versus 19% respectively, Dominican Republic exhibited much higher observed levels of fungibility than Indonesia. ODA in Dominican Republic was found to be fully fungible with public expenditure being diverted toward non development activities of debt and deficit reduction (Pack & Pack, 1993), whilst in Indonesia, Pack & Pack, (1990) found that ODA was not fungible with one dollar of aid resulting in total public spending on development activities increasing by $1.58.

As a rebuttal to Pack & Pack's point, it might be argued that advocating for bulk aid as a means of potentially reducing fungibility may produce unwanted ills such as increased aid dependency. This is especially the case, where aid recipients mostly receive aid from numerous donors. A more practical approach to decreasing fungibility may be to rather advocate for coordination amongst donors. Along these lines, Devarajan, Rajkumar & Swaroop (1999) found that an inverse relationship existed between the number of donors and the level of fungibility. The authors argue that a moral hazard is created as the number of donor rises, where recipients would anticipate that a single donor would find it difficult to single out the impact of their flows and as such are more likely to treat aid as fungible. In particular, Devarajan, Rajkumar & Swaroop (1999) found that in 18 Sub-Saharan African countries for the telecommunications and education sectors, the number of donors was inversely related to the level of fungibility. These results suggest that to minimise the potential for aid fungibility there needs to be donor coordination in terms of monitoring and tracking their collective impact of aid on public expenditures.

Other studies have put forward that aid modality (i.e. the instruments chosen to deliver foreign aid) influences the levels of aid fungibility. Aid is largely disbursed either as project aid, where donors design, fund and execute projects, or as budget support, where donors fund beneficiaries through national or ministerial public budgets. Some advocates of project aid argued that project aid offers a higher economic rate of return as compared to budget support given that aid is accompanied with technical support as well it increases the control and visibility donors have on disbursed aid (Tarekegn, 2002). However, project aid has been found to undermine the effectiveness of aid by crowding out own expenditures(Cordella & Dell'Ariccia, 2007). This is to say, in response to a donor funded and executed project a beneficiary government is able to divert away their own resources toward other uses given that the needed development

investment has been funded as well as executed. For example, Gottret & Schieber (2006) found in a cross-country study that a $1.00 increase in project funding in DAH resulted in a $1.65 decrease in government expenditures in the sector. Donors, in the case of budget support, can also impose conditionality on how to allocate the available resources such using concessionary loans which having matching requirements. For example, in a cross –country study of 14 countries (1971-1990) it was found that a dollar increase in concessionary loans lead to a $1.24 increase in government expenditure (Feyzioglu, Swaroop & Zhu, 1998).

A running thread in the conclusions of most fungibility studies have mainly aimed to inform means of minimising or avoiding fungibility. In fact, there is growing support including development agencies toward avoiding disbursing aid to countries that have evidence of fungibility(World Bank, 1998). These sentiments are largely driven by the assumption that fungibility is indicative of poor governance or institutional quality such as corruption. Along similar lines, , Pack and Pack (1998) further point out that the differences in levels of fungibility between the Dominican Republic and Indonesia was also a function of the differences in fiscal policies. The Dominican Republic run consistently run high fiscal deficits which encouraged aid to be treated as fungible. In contrast, Indonesia had no aid fungibility which the authors argue is due to the government employing conservative fiscal policies despite having large oil reserve revenues and high inflows of aid.

Although these recommendations bear some compelling arguments, there have been dissenters that have argued that the concept of fungibility should not be the most central concern in shaping donor policies on improving the effectiveness of aid.

Pettersson (2007) discourages against the use of fungibility as a means of selecting which countries should receive aid, as he argues that such policies need to be based on conclusive evidence that fungible aid funds are indeed less productive than non-fungible funds. To this end, Pettersson (2007) tested his assertion for aid in 60 countries and found that there were no significant statistical differences in productivity of fungible and non-fungible funds. These results may suggest that aid recipients may be as well informed as donors as to where additional resources of revenue are needed and more productive. Additionally, Pettersson (2007) found that governments with good institutional quality and responsible fiscal policies also had evidence of fungibility. Therefore using poor governance as an indicator of fungibility may

prematurely lead to recipient countries that are need of aid not receiving aid on account of perceived poor governance.

Fungibility may potentially not be a 'bad' outcome and may actually indicate other underlying dynamics. For example, fungibility may rather signal a divergence of donor and aid recipient government priorities. To illustrate this concept, one can look at the case of Sri Lanka and Indonesia, which despite having similar shares to aid going to health and education have significant differences in the level of aid fungibility in these sectors. More specifically, in response to receiving 5.9 cents of aid to the education and health sectors from each dollar of total aid, Sri Lanka reduced public expenditures toward these sectors by 1.9 cents whilst Indonesia experienced an increase of 18.9 cents of public expenditure to health and education for every 7.2 cents of aid received in these sectors(World Bank, 1998).

Along similar lines, there is growing consensus within the literature that fungibility in itself is too narrowly focused on the composition of expenditures and making sure that aid is used in accordance to donor wishes. Fiscal response studies argue that aid has much wider economic effects in that it may influence recipient government's incentives to increase domestic revenues mobilisation. (Mcgillivray & Morrissey, 2000, 2001) argues that fungibility studies mostly ignore these effects, which may be more insightful in understand how aid may impact not only spending behaviours of recipient government but also their assertion to increasing revenues. The next section explores Fiscal response studies in more detail.

2.3.3 Fiscal Response of Aid

2.3.4 The Theory of Fiscal Response of Aid

The first fiscal response study was carried out by Heller (1975a) and subsequently adopted by other authors ((Mosley, Hudson & Horrell, 1987; Gang & Khan, 1991; Franco-Rodriguez, Morrissey & McGillivray, 1998; Gupta et al., 2003; Clist & Morrissey, 2011; Mavrotas, 2014). These studies much like aid fungibility studies focus on the utility maximising principle albeit using different functions. Fiscal response studies postulate that aid recipient governments maximise their utility when they achieve predetermined revenue and expenditure targets against a given budget constraint. Public expenditure as referred to in fiscal response studies consists of government consumption and public sector investment, whilst government revenue which constitutes as a budget constraint derived from tax and borrowings. Therefore assuming that the public sector acts as a utility maximising agent, it fashions its utility function in accordance to:

Equation 1: $U = U(Ig, G, T, B)$ *where,*

U = Utility
Ig =Public Investment
G = Government Consumption
T = Tax
B = Borrowings

The utility maximisation equation is presented in more detailed in a quadratic function:

Equation 2: $$U = \alpha_0 - \frac{\alpha_1}{2}(I_g - I^*_g)^2 - \frac{\alpha_2}{2}(G - G^*_g)^2 - \frac{\alpha_3}{2}(T - T^*_g)^2 - \frac{\alpha_4}{2}(B - B^*_g)^2$$

The variables with asterix I*,T*,B*,G* represent the exogenous targets levels of the endogenous revenue and expenditure variables of I,G,T,B. Equation 2 above more clearly illustrates the point that government will maximise its utility when it achieves all expenditure and revenue targets. However government is subject to a budget constraint when attempting to maximise its utility.

The standard fiscal response model treats aid as exogenous and sees aid as an external source of revenue that influences the budget constraint. Additionally, aid is seen as additional revenue to be used for public investment as opposed to consumption expenditures. Hellen (1975) quantifies this constraint in the following equations:

Equation 3: $G + Ig = T+A+B$ where

Ig =Public Investment
G = Government Consumption
T = Tax
B = Borrowings
A = Aid (includes grants and loans)

In attempting to maximise their utility, recipient governments can respond to an exogenous inflow of aid through four main channels. Firstly, holding expenditure and borrowings constant, in meeting its budget constraint recipient government can reduce its tax effort after receiving aid, in so doing allowing aid to subsidise previously tax financed revenues. In this same vain, Gupta et al., (2003) point out an extreme case where, governments can decide to entirely reduce its tax effort by the amount of aid received. Secondly, holding tax and government expenditure constant, in response to an inflow of aid governments can reduce their domestic borrowings therefore allowing aid to finance a portion of revenue usually derived from domestic borrowings. Thirdly, holding tax and borrowings constant in response to an inflow of aid, recipient government can increase their government expenditure by the amount of aid received. However, the extent to which government expenditure can increase may be enhanced by governments altering their attitudes toward raising revenue from tax and domestic borrowings. For example, if borrowings are held constant, government expenditure may increase by less that than the increase in aid if governments also reduce their tax efforts. Likewise, government expenditure may increase by more that than the increase in aid if governments increase their tax efforts.

2.3.5 Empirical Findings on the Fiscal Response to Aid

In Heller's (1975) seminal work on fiscal response, the impact of aid on various fiscal aggregates such as tax, borrowings, socio-economic consumption, civil consumption and developmental public expenditure in eleven African countries was examined. The study

revealed that increase in aid resulted in a less than proportionate increase in total expenditure (toward investment rather than consumption) as aid also led to a reduction in domestic taxes and borrowing. Heller (1975), further points out that the extent of the impact of aid on public fiscal behaviour largely dependent on the modality of aid. This is to say, Heller (1975) found that aid disbursed as grants led to higher increases in government consumption by reducing tax whilst loans led to higher increases in public investment expenditures. The difference in payment terms of grant versus loan aid may explain the difference in observed levels of fiscal response. This is to say, recipient governments are incentivised to decrease tax or borrowings when they receive grant aid as they do not need to pay back grants. In contrast, given that aid disbursed as a loan needs to be repaid the recipient government is incentivised to increase their tax and borrowing burden in order to service the loan. Subsequent studies using Heller's (1975) model have also found similar results regarding the influence of aid modality on fiscal response. For example, in a study of five South and South East Asian countries, Khan & Hoshino (1992) found that 85cents of a dollar of aid disbursed as a loan was used for public investment whilst only 32cents of every dollar of grant aid was used for investment purposes. Additionally, the authors found that grant aid led to a decrease in tax whilst loans resulted in an increase in tax. The authors argue that the burden of loan payments on recipient governments induce governments to not only increase tax but also spend the aid inflow on investment expenditures that will yield them a return on investment which can additionally contribute toward servicing the loan (Khan & Hoshino, 1992).

More recent studies have placed less weight on cross –country studies and have largely opted to focus on individual country studies as the fiscal response of government is more likely unique to a given country. This is evident in the array of largely divergent results from the country case studies.

Franco-Rodriguez, Morrissey & McGillivray, (1998) find that donors should increasingly be concerned with the fiscal response of aid in Pakistan. The authors find that whilst an additional rupee of committed aid resulted in a .05 rupee increase in investment expenditure, total expenditures decreased by 2.31 rupees. With regards to domestic revenue, 1 rupee change in aid in Pakistan resulted in a decrease of tax by 3.59 rupees and an increase in borrowings of 0.88 rupee, which further suggests that inflow of aid in the country negatively impacts public sector saving (Franco-Rodriguez, Morrissey & McGillivray, 1998). Similar to the Pakistan, Mcgillivray & Ahmed (1999) found that in response to one Peso of multilateral aid tax

decreased by .98 Pesos whilst an increase in one Peso of bilateral aid led to a.98 Pesos decrease in tax. In contrast, aid has been found to cause an increase in tax and reduction in borrowings in Costa Rica whilst in India aid had no impact on tax or borrowings (Franco-Rodriguez, 2000; Swaroop, Jha & Sunil, 2000).

Unlike fungibility studies there has been relatively fewer studies focusing on the fiscal response of recipient governments to inflows of aid. To the best of our knowledge, fiscal response studies that do exists have largely focused on the impact of aid at the macro level with no studies having investigate the fiscal effects of sectoral aid on sectoral fiscal aggregates. This is largely due to the availability of data as well as the fact that in developing countries fiscal revenue aggregates such as tax, borrowings are largely done at the national level (Mcgillivray & Morrissey, 2001).

However, the results of fiscal response studies albeit at the macro level can reveal downstream fiscal effects at the sectoral level. This is especially the case for the agriculture sector, which is largely reliant on receiving not only external development assistance but tax from other sectors. This is because the low monetization of the agriculture sector in developing countries adversely affects its ability to raise the needed revenue to sustain its funding needs. This is largely due to the high proportion of smallholder subsistence farmers which fall well below taxable income thresholds (Aguirre, Griffith & Yucelik, 1981) As such, the indications in the fiscal response that aid may have a negative impact on tax revenue effort may therefore reduce potentially the amount of public revenues that can flow to the agriculture sector .

Similarly, findings that aid may lead to increased national borrowings and therefore increased fiscal deficits have important implication for the agriculture sector (Mcgillivray & Morrissey, 2001).Fiscal deficits for example are argued to exert upward pressure on interest rates(Aisen & Hauner, 2008). This occurs when in a bid to finance the budget deficit through increased borrowings, government incentivises the private sector to purchase government bonds government by increasing real interest rates. Schaub & Sumner (1993) argue that interest rates can impact agriculture through three main channels, namely debt, investment and land value. A rise in interest rates may result in a reduced access to finance for small holder farmers as high interest rates would increase borrowing costs to levels that smallholder farmers cannot afford. Interest rates also may also lower the value of land, given that farm land value is found by discounting expected farm earnings with prevailing interest rates. Finally, increasing interest

rates negatively impact agricultural investment. This is because, in the case that interest rates is higher than the rate of return would disincentives individuals from making agricultural investments and further crowd out public investment.

Within the fiscal response as well as fungibility study there appears to be little consensus on the impact of aid on public expenditures. Firstly, fungibility study results range from indicating that aid has no impact on aid to situations in which aid may actually cause a more than proportionate increase in public expenditures. There has also been a divergence in ideas to explain why in some case aid leads to higher public expenditures whilst in others leads to a decrease in public expenditures. This has also been the case in fiscal response studies with which the impact of aid on fiscal aggregates range from aid increasing domestic resource mobilisation to cases in which it displaces it. Perhaps a more pertinent observation is despite the significance of agriculture in developing countries there has been little attention paid by these studies in understanding the impact of aid both at the sectoral and national level on public expenditures in the agriculture sector. In particular, we identified two gaps in the aid fungibility and fiscal response literature that we believe could inform this neglected research area. First, in his cross country study (fifty seven countries) of the influence of governance on fungibility Pettersson (2007) did not analyse the fungibility of aid to agriculture in isolation but rather aggregated agricultural aid with other sectors including energy, and transportation. Second, within fiscal response studies no study had specifically analysed the fiscal effects of aid on a subset of aid dependent developing countries in which agriculture is a significant portion of the economy. In the next section we aim to provide the results as well as the discussion of our empirical analysis which aimed to investigate the fiscal effects of aid in the agricultural sector.

3 RESEARCH METHODOLOGY

This chapter aims to present the research methodology and strategy used in the empirical analysis of the study. To this end, an overview of the study area, research design, sample selection, data collection, and data analysis methods employed in the study are described. In addition, study limitations and the techniques employed to ensure the validity and reliability of the study are discussed.

3.1 Research Approach and Strategy

3.1.1 Scope of study

Using both descriptive and empirical analysis, the study explored factors that might adversely affect the amount of public spending committed to agriculture. The level of public spending is likely influenced by both aid received as well as sources of government revenue such as taxes that can be distributed to the sector. Thus, the study aimed to investigate the impact of ODA inflows on public expenditure and tax revenue in a sample of sixty-six low- and middle-income countries.

First, a fungibility study was undertaken to investigate the direct impact of aid to agriculture on public expenditure in the sector. In addition, we investigated if quality of governance influenced the level of aid fungibility. The following primary research questions were explored:

i. **To what extent is aid to the agricultural sector fungible in low- and middle-income countries (LMICs)?**

ii. **Are LMICs with poor governance more likely to have fungible aid in the agriculture sector?**

Secondly, a fiscal response study was conducted to ascertain the impact of specific types of aid (i.e. grant and loans) on domestic resource mobilisation, by answering the following research question:

iii. **Does aid committed in the form of loans lead to higher tax raising efforts aid committed as grants?**

Results of the fiscal response study aimed to inform which aid flow type maximised domestic resource mobilisation in low- and middle-income countries.

3.2 Data Collection, Frequency and Choice of Data

Data used in the study was exclusively secondary data collected from online data repositories. To ensure consistency and comparability across currency data, where applicable currency data expressed in current US $ was converted into constant 2005 USD prices. To do this, the 2005 US Consumer Price Index (CPI) collected from the US Bureau of Labour Statistics (www.bls.gov/cpi/home.htm) was used to deflate/inflate data expressed in dollars in various years to constant 2005 levels.

3.2.1 Fungibility Study Data

For the fungibility study the following time series data was collected for a sample of ODA recipient countries:

i. ***Population data*** was gathered from the World Bank Development Indicators (WDI) repository and was used to calculate per capita values for all variables in the model. Population statistics in the World Bank data set contains the annual mid-year estimate of country population excluding refugees with no permanent asylum status (The World Bank, 2014)**.**

ii. ***Public agricultural expenditure data*** was collected from the International Food Policy Research Institute's (IFPRI) public expenditure database, Statistics of Public Expenditure for Economic Development (SPEED). SPEED data comprises primarily of data from the IMF Government Financial Statistics Yearbook (GFS) and is supplemented by in-country information gathered from various national sources such as national bureaus of statistics, ministries of finance, general accountant offices and central banks (SPEED, 2013). SPEED data aggregates and reports agricultural public expenditure data based on the IMF's COFOG as indicated in Appendix A.

iii. ***Official aid to agriculture*** data was collected from the AidData database (www.aiddata.org) which tracks all aid OECD and non-OECD commitment and disbursements amounts (AidData, 2014). In line with the DAC definition of aid to agriculture, AidData considers aid to agriculture to include all aid commitments targeting agriculture, fishing, and forestry, as indicated in Appendix B.

iv. ***Gross Domestic Product (GDP)*** data was collected from the WDI database. World Bank methodology derives GDP data by summating gross value added by all producers in the economy net of product taxes not included in the products value.

v. ***Food Aid*** data was collected from the AidData database and in line with DAC definitions accounts for all aid flows committed to providing emergency food aid to high risk populations affected by adverse climatic or conflict conditions.

vi. ***Governance index*** data was collected from the Worldwide Governance Indicators (WGI) database. The governance index reflects the perception of a mix of enterprises, citizen and experts from developed and developing countries on the quality of public services, policy formation and implementation in a given country. The index ranges from -2.5 (weak) to 2.5 (strong).

3.2.2 Fiscal Response Study Data

For the fiscal response study the following time series data was collected for a sample of ODA recipient countries:

i. ***Gross Domestic Product (GDP)*** data was collected from the WDI database. World Bank methodology derives GDP data as described above in section 1.2.1.

ii. ***Tax Revenue as a percent of GDP*** was collected from the WDI database and comprises all compulsory, non-repayable receipts to the central government for public purposes as a percentage of current GDP.

iii. ***GDP per Capita*** was collected from the WDI database and comprises of GDP figures expressed as a ratio of midyear population estimates.

iv. ***Agricultural Value Added as per cent of GDP*** was collected from the WDI database and corresponds to the net output of activities related to agriculture (crop and livestock production), fishing and forestry expressed as a percentage of GDP.

v. ***Industrial Value Added as per cent of GDP*** data was collected from the WDI database and comprises the net output of activities related to mining, manufacturing, construction, electricity, water and gas expressed as a percentage of GDP.

vi. ***Imports of Goods and Services as per cent of GDP*** data was collected from the WDI database and includes the value of goods and service purchased from international trade markets expressed as a percentage of GDP.

vii. ***Exports of Goods and Services as per cent of GDP*** data was collected from the WDI database and includes the value of goods and service produced in a country and sold to the international trade markets expressed as a percentage of GDP.

viii. ***ODA Grants as a percentage of GDP*** data was collected from the Aiddata database and comprises all ODA transfers made available to a recipient which carries a repayment obligation. To calculate total annual ODA grant flows as percentage of GDP for each recipient country, all ODA grant flows corresponding to a particular year were summated and divided by the annual GDP

ix. ***Net ODA Loans as a percentage of GDP*** data was obtained from the Aiddata database and includes all ODA flows extended to recipient governments of which a portion is required to be repaid (using soft interest rates such as 0%) and where at a minimum 25% of the total commitment amount may be in the form of a grant. To calculate total annual net loan flows as percentage of GDP for each recipient country, all ODA loan flows corresponding to a particular year were summated and divided by annual GDP.

3.3 Sampling

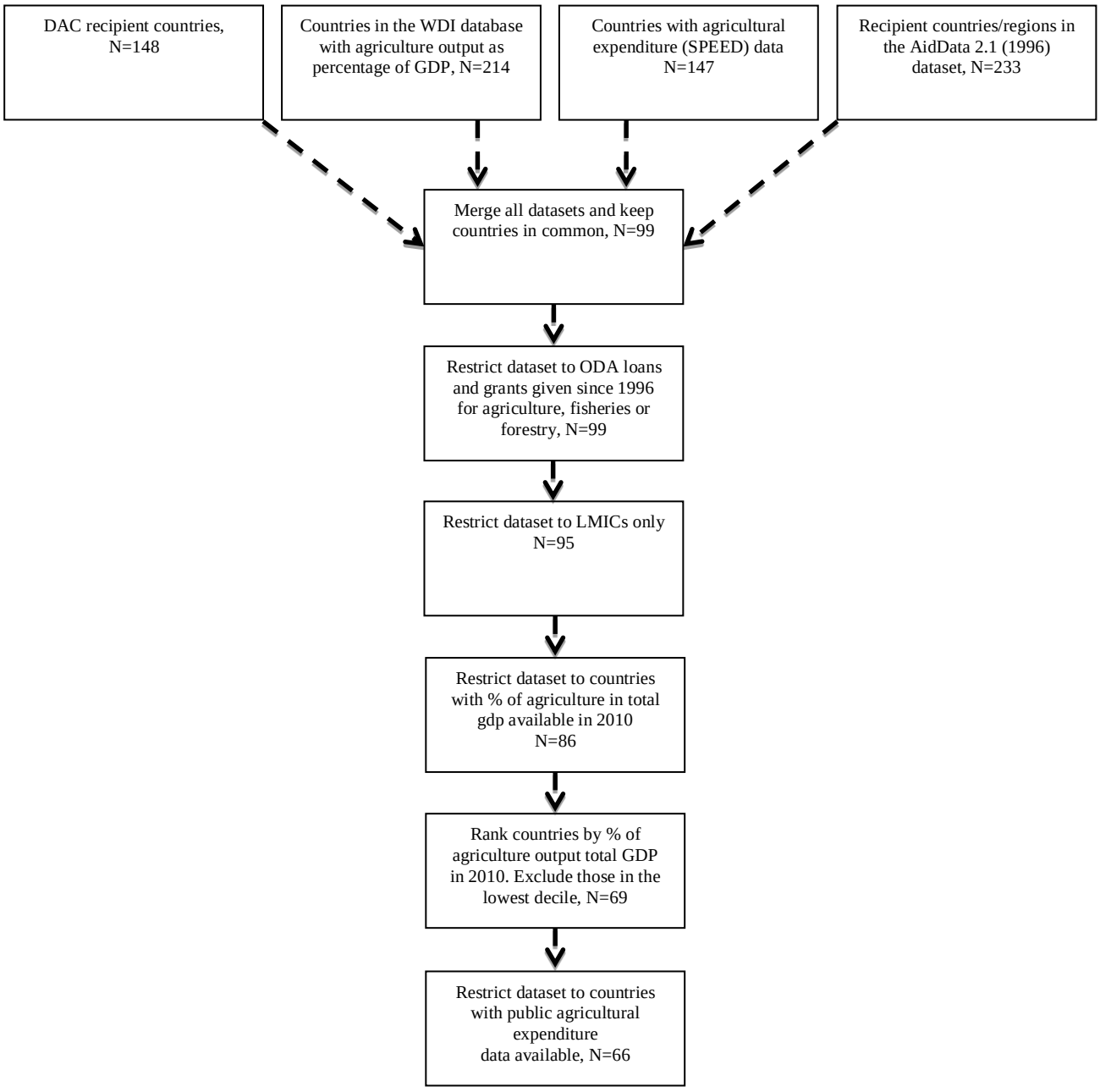
Due to the availability of data, both the fiscal response and fungibility study were conducted over a 15 year study period, from 1996 to 2010.

To undertake the fiscal response and fungibility studies a sample of DAC recipient countries was selected from the full population set of all DAC aid recipients using purposive sampling techniques. This is to say, randomisation was not used in the sampling process and countries included met certain criterion which enabled us to answer study research questions (Kumar, 2014). The study focused on low-and middle-income countries in which agriculture was an important component of the economy and data was available for public expenditure and aid to agriculture.

The sampling procedure used is illustrated in Figure 3. As a first step, we collected time series data for DAC recipient countries including agricultural output (available in the WDI dataset), public expenditure (available in the SPEED dataset), and ODA received (available in the AidData dataset). These four preliminary datasets were then merged and countries in common were retained (n=99). High-income countries were then excluded, leaving 95 low- and middle-

income countries. Of the 95 low- and middle-income countries, 13 were then excluded as they were missing agricultural output as a percentage of GDP in 2010. The remaining 86 countries were ranked according to agricultural output as a percentage of GDP and those ranked in the lowest decile (corresponding to 7% of GDP or less) were excluded. Finally, of the remaining 69 countries, 3 countries were removed due to unavailability of public agricultural expenditure data. Thus, the final sample set included 66 low- and middle-income countries as listed in Appendix C.

Figure 3: Sample Selection Procedure



3.4 Data Analysis Methods

To evaluate the impact of aid on public expenditure to agriculture and tax revenues, we used panel regression analysis, which pools both cross-sectional and time series data. Covariates for individual countries were collected at points in time (cross-sections) and repeatedly across time periods from 1996-2010 (time series).

3.4.1 Model Specification for Fungibility Test

The methodology of Pack & Pack (1990) in their study of sectorial fungibility in Indonesia was used as a basis for our fungibility empirical model. This method has been employed in numerous fungibility studies, including those which focused on the Dominican Republic (Pack & Pack, 1993), Nepal (Bhattarai, 2007), and cross-country studies (Feyzioglu, Swaroop & Zhu, 1998; Pettersson, 2007).

In their study of Indonesia, Pack and Pack (1990) estimated a series of linear expenditure equations subject to the following government constraint:

$$\mathbf{CE}_t + \mathbf{D}_t = \mathbf{R}_t + \mathbf{AID}_t$$

where,

CE_t = per capita non-development expenditures

D_t = per capita government development expenditure per category

R_t = per capita total revenue net of aid in time

AID_t = total aid received per capita

The series of linear expenditure equations that were estimated are as follows:

$$D_{i,t} = g\,(GDP_t, AID_{i,t}, OAID_{i,t}, TIME),$$

$$CE_t = f\,(GDP_t, AID_t)$$

$$R_t = h\,(Oil_t, Non\text{-}oil_t, AID_t)$$

$D_{i,t}$ quantifies per capita government development expenditure per category *i*, in year *t*, and is a function aid per capita for expenditure category *i* ($AID_{i,t}$), all other aid flows to non *i* categories ($OAID_{i,t,}$), and a time variable indicating the year (TIME). Pack and Pack (1990) therefore tested for fungibility by estimating the extent to which aid for a specific sector is diverted toward use in another sector. CE_t are the per capita non development expenditures not supported by aid in year *t* and is a function of per capita GDP at time t (GDP_t) and total sectoral aid per capita at time *t*. Rt is per capita total revenue net of aid at time *t* and is a function of revenues from taxation on oil and non-oil (e.g. gas) resources.

For the purposes of our study we deviated slightly from the Pack and Pack methodology and did not estimate the effect of aid to agriculture on each part of the government equation but rather only on public expenditures to agriculture. In addition, in terms of estimating fungibility, unlike Pack and Pack (1990) we did not attempt to identify where aid to agriculture is diverted (i.e. to which other sectors), largely due to the availability of data. By modifying Pack and Pack's (1990) first equation ($D_{i,t}$) we estimated the following equation:

$$\mathbf{AGE_t} = \beta_{0AG} + \beta_{1AG}\mathbf{GDP_t} + \beta_{2AG}\mathbf{AAG_t} + \beta_{3AG}\mathbf{EMG_t} + \beta_{4AG}\mathbf{TIME_t} + \mathcal{E}_{AG}$$

where,

AGE_t = per capita public expenditure to agriculture

GDP_t = per capita GDP

AAG_t = per capita aid to agriculture

EMG_t = Emergency food aid

In the above equation, we aim to model the effect of aid to agriculture (AAG_t) on public expenditures to agriculture, (AGE_t) whilst controlling for economic growth using GDP per capita as a proxy. Following from Pettersson (2007) we integrated the potential shocks in the economy that may influence public expenditures by also including a dummy variable, EMG_t to account for whether a country was the recipient of emergency aid.

The beta point estimates (β) estimate the impact of a unit increases in model variables on public expenditures. The extent of fungibility would therefore be observed by the magnitude and direction of β_{2AG}, more specifically:

i. ***Full Fungibility*** = $\beta_{2AG} < -1$, where 1 unit increase in aid leads to a decrease in expenditure of the same or greater magnitude suggesting all aid to agriculture is diverted to other uses.

ii. ***Partial Fungibility*** = $-1 < \beta_{2AG} < 1$, where a 1 unit increase in aid leads to a less than proportionate increase in public expenditures therefore a portion of aid is diverted to non-agriculture uses.

iii. ***No Fungibility*** = $\beta_{2AG} > 1$, where a 1 unit increase in aid lead to an equal or larger increase in public expenditures therefore all aid to agriculture is used in the sector.

In addition to the main fungibility analyses, a sub-analysis was conducted in which the World Bank governance index was included as a model variable, G (see equation below). This was used to answer the second research question and ascertain if institutional quality influenced levels of fungibility of aid to agriculture.

$$\mathbf{AGE_t = \beta_{0AG} + \beta_{1AG}GDP_t + \beta_{2AG}AAG_t + \beta_{3AG}G + \beta_{4AG}EMG_t + \beta_{5AG}TIME_t + \mathcal{E}_{AG}}$$

3.4.2 Model Specification for Fiscal Response Study

This study employed the regression model used by Gupta *et al.* (2003) to analyse the effect of aid on tax revenue in the study sample of countries. This methodology was chosen as Gupta *et al.* (2003) were the first to examine the effect of aid composition (loan verse grants) on tax revenue in a large cross-country study (using a sample of 107 countries). The model has also been used in other cross-country studies studying similar subject matter (Clist & Morrissey, 2011) and as such allow study results to be more consistently compared to other study results. The study used the following equation to model the impact of aid on recipient tax effort by regressing tax revenue against aid disbursed (distinguishing between loans and grants) whilst accounting for variables that would proxy for the tax base structure:

$$\mathbf{T/GDP = \beta_0 + \beta_1 AGR + \beta_2 IND + \beta_3 INCOME + \beta_4 GRANT + \beta_5 LOAN + \beta_6 M + \beta_7 X + \mathcal{E}}$$

where,

T/GDP = Tax revenue as a percentage of GDP

AGR = Agriculture output as a percentage of GDP

IND = Industry output as a percentage of GDP

TRADE = Trade taxes (form imports and exports) as a percentage of GDP

INCOME = GDP per capita

GRANT = Total aid grant as a percentage of GDP

LOAN = Total loan grant as a percentage of GDP

T/ GDP is regressed against total aid disaggregated by composition to see the influence of aid disbursed as a loan (LOAN) and as a grant (GRANT) on tax. A positive beta coefficient ($\beta_4 > 0$; $\beta_5 > 0$) for GRANT and LOAN variables indicate a positive impact of aid on tax, whist negative coefficients ($\beta_4 < 0$; $\beta_5 < 0$) indicate the opposite effect. To account for the economic structure of countries within the sample, agricultural (AGR) and industrial (IND) value added as a percentage of GDP were included to indicate the taxable capacity of the recipient country. For instance, a large agriculture sector in developing countries means that the tax base is relatively small ($\beta_1 < 0$) given that the sector mainly consists of subsistence farmers who fall outside taxable income brackets (Emran & Stiglitz, 2005). In contrast a large industrial sector would indicate the tax base of the country is relatively high ($\beta_1 > 0$) given that the industrial sector is normally commercial in nature and as such is taxable (Clist & Morrissey, 2011). The model also included trade variables in order to account for the fact that trade tax revenues comprise a large share of tax revenue in developing countries (Greenaway & Milner, 1991; Ghura, 1998). Following from Clist & Morrissey, (2011) we slightly modified Gupta *et al.* (2003) model by disaggregating the trade variables into two variables, namely imports (M) and exports (X) to account for the fact that imports and exports are often charged at different rates which means their impact on tax revenue may be different. To account for the level of economic development which may influence the amount of taxable individuals and therefore the amount of tax collected, GDP per capita (INCOME) is included in the regression equation.

3.5 Research Reliability and Validity

3.5.1 Research Validity

Research validity is concerned with ensuring that research instruments of choice have measured what they intended to measure (Drost, 2004). Quantitative statistical analysis should strive to

ensure both internal and external validity. Internal validity is concerned with ensuring the research design is appropriate in testing the hypothesis that aim to answer the research questions for the sample being studied. External validity concerns whether or not research findings and conclusions pertaining to a particular sample can be generalized to a whole population.

3.5.1.1 Internal Validity

To ensure the internal validity of this study we first tested that the data used met the assumptions of panel regression analysis. As asserted by Antonakis & Dietz (2011), disregarding regression assumptions can lead to Type I (mistakenly accepting the null hypothesis) or Type II (mistakenly rejecting the null hypothesis) errors or over- or under-estimation of the significance of point estimates of the effects of independent variables on dependent variables. In this regard, we conducted various statistical diagnostic tests in order to identify if there were any violations of panel regression analysis so as to inform which panel regression modelling technique would be appropriate given the underlying data. The results of the statistical diagnostic tests, including remedial actions for observed violations are presented in section 4.1.1 and 4.4.2.

The following statistical diagnostics tests were conducted prior to conducting both fungibility and fiscal response studies:

i. **Test for Autocorrelation (serial correlation):** Panel regression assumes that past error terms are not correlated to error terms in successive future years. Using the Durbin Watson (DW) test we tested for first-order serial correlation errors, where past error residuals are tested for serial correlation with only the proceeding time period. The DW test tests the null hypothesis that errors are not correlated against the alternative hypothesis that error terms are correlated. The DW statistic falls within a 0-4 range. A DW statistic closer to zero indicates positive serial correlation whereby positive error terms are likely to lead to other error terms being positive. A DW statistic closer to two indicates no serial correlation (null hypothesis for no auto-correlation cannot be rejected), while a DW statistic closer to four indicates negative serial correlation whereby positive error terms are likely to lead to other error terms being negative.

ii. **Tests on Nonlinearity**: Panel regression analysis assumes that dependent and independent variables are linearly related. In the case that the assumption of linearity is violated the model would result in biased parameter estimates. Graphical techniques

were used to observe the linearity between independent and dependent variables. More specifically, partial regression plots of dependent against independent variable observations were created. If observations followed a linear trend (straight line) then the assumption of linearity would not be violated and if observations did not follow a linear rend (e.g. curved trend) then nonlinearity is present.

iii. **Test for Heteroskedasticity:** Panel regression assumes homogeneity in the variance of regression residual terms. A violation of this assumption would mean that residuals are heteroskedastic in that the variance between residuals is non-constant. The study employed both graphical and statistical test to ascertain if heteroskedasticity existed the study model. Firstly, the pattern of residuals and fitted (predicted) values was plotted. If the scatter plot showed a random pattern of data points then the model would be valid as residual variance would be homogenous whilst if a clear pattern emerged then the residual variance would be heteroskedastic and model validity would be violated. In addition we conducted the Lagrange Multiplier test proposed by Engel (1982) to formally test for Autoregressive Conditional Heteroskedasticity (ARCH) effects in which error terms have time varying volatility.

iv. **Test for Stationary:** Panel regression assumes that the underlying time series data is stationary in that it is predictable and can be modelled or forecasted or alternatively does not have a unit root problem. In the case that non-stationary data is used, biased estimators will be produced which may indicate a relationship between dependent and regressor variables that may not exist. The Augmented Dikey-Fuller test was employed to test the null hypothesis that variables contain a unit root against the alternative hypothesis that the variables are stationary. The t-test statistic produced is compared to the critical values and value at 5% significance level.

3.5.1.2 External Validity

External validity was ensured through the sampling methodology. This is to say, we ensured that the sample size was large enough to infer results onto to a larger population. In particular, we made sure that the sample size had variance with respect to geographic as well as income level, in order to account for the disparity across low-and middle-income groups (see section 4.1 for sample description).

3.6 Study Limitations

Given that the data collected is exclusively secondary, it leaves the quality of data at the mercy of various agents involved in the capturing and recording of primary data which may affect the consistency and reliability data. For example, much of the data used is produced by national statistical systems (NSS) in developing countries. NSS are notoriously under-funded and therefore do not have the required capacity to efficiently and effectively produce good quality statistics that are reliable, accurate, accessible and timely (Fonton & Hounkonnou, 2014). Country time series data was also often missing, which limited the number of countries that could be include in the sample. In addition, given that the study used various data repositories that collated both NSS and donor data, each using varying data collection and recording methodologies this may affect comparability and consistency of data across study participants.

Inconsistencies in the data may stem from differences in the interpretation of how particular data should be classified. For example, how governments classify agricultural activities may be inconsistent, as use of the IMF's COFOG is not mandatory (Fan, Omilola & Lambert, 2009). Additionally, donor agencies have different interpretations of what constitutes agriculture and what constitutes food aid which are reported using different accounting systems (ODI, 2012). Islam (2011) points out two main shortcomings regarding DAC's data on aid to agriculture. Firstly, in the OCED/DAC database aid to agriculture consists of the summation of all aid to agriculture, forestry and fisheries, classified under the category AFF (Agriculture, Forestry and Fisheries), however it is only from 1994 that the data has been disaggregated to allow for analysis of the different sub-sectoral components of AFF. Secondly, the OECD/DAC database has categories which amalgamate some aid flows to agriculture with other aid flows making it difficult to distinguish if there exists any additional flows to agriculture. For example, aid disbursed for multiple sectors is categorized under the dominant component of aid, meaning that if 60% of disbursed aid is for financial services and the remainder to agriculture, the aid flow will be classified under the financial services category. Similarily, aid intended for multiple sectors where no one sector dominates is categorized as "multi-sectoral aid". In the same token, if aid is unable to be classified in accordance with any of the CSR purpose codes it is classified as "un-allocable aid". Additionally, ODI (2012) acknowledges that the use of different reporting systems and interpretations of agricultural aid by donors may lead to the loss of aid flow data if these different systems and definitions do not directly translate to the DAC system.

Thus, conventional measures of aid to agriculture may ignore important sources of assistance to agriculture and therefore underestimate the magnitude of these external aid flows (ODI, 2012). For example, DAC's definition of aid to agriculture excludes a significant portion of aid from the International Fund for Agricultural Development (IFAD), a United Nations agency focusing on the development of agriculture and the rural poor. Between 2003 and 2009 DAC excluded 46% of IFAD funding from its recorded flows of agricultural aid, because this funding was used for developing value chain financing as it did not fall under the DAC definition of aid to agriculture. Additionally, DAC excluded IFAD's funding of financial services despite the fact that access to finance for farmers contributes to agricultural development.

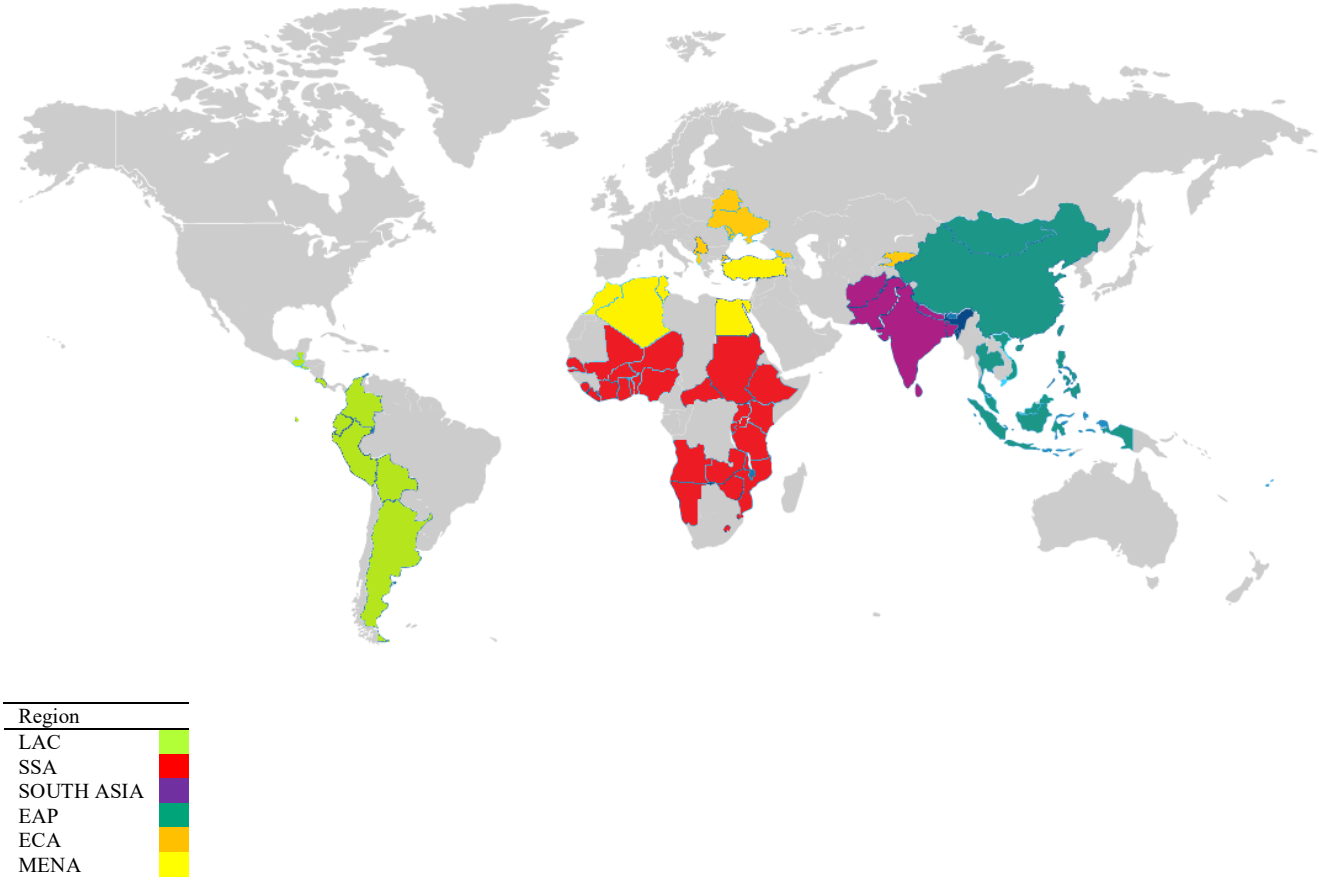
4 RESEARCH FINDINGS, ANALYSIS AND DISCUSSION

This chapter divides our research findings into three main sections. The first section provides a description of the sample with the aim of showing the region distribution and income level of countries included. The second section provides a summary of the results from our descriptive and empirical analysis. The third section then provides an analysis and discussion of these results.

4.1 Sample Description

The final sample included sixty-six countries selected using the methodology presented in section three and shown in Figure 4 (the complete list is shown in Appendix C).

Figure 4: Geographical Distribution of Study Sample



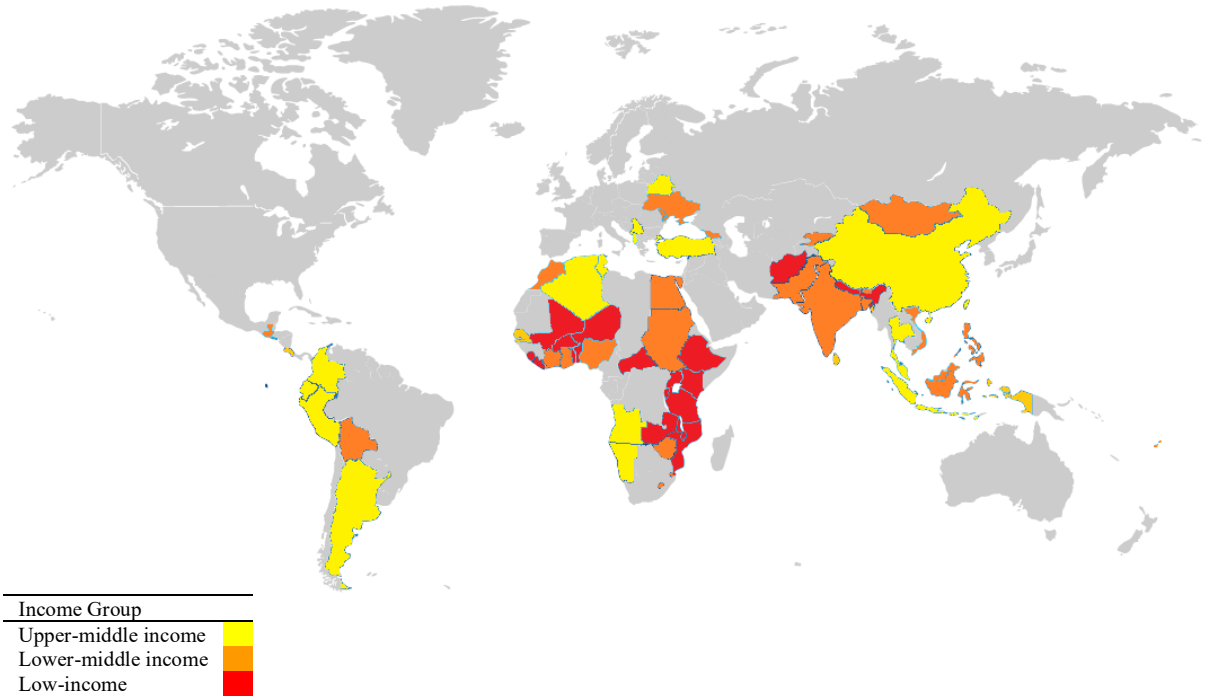
As indicated in Table 1 below, the data used in the study included developing countries spread over six regions, including the East Asia and Pacific (EAP) region, East and Central Asia (ECA), Latin America and the Caribbean (LAC), the Middle East and North Africa (MENA), South Asia, and sub-Saharan Africa (SSA). The majority of countries in the sample are located in the sub-Saharan region (42%), followed by EAP (15%), LAC (14%), South Asia (11%), ECA (11%) and MENA (8%).

Table 1: Regional Distribution of Study Sample (Frequency)

Region	Frequency	Percentage
East Asia and Pacific (EAP)	10	15%
East and Central Asia (ECA)	7	11%
Latin and Caribbean (LAC)	9	14%
Middle East and North Africa (MENA)	5	8%
South Asia	7	11%
Sub Saharan Africa (SSA)	28	42%
Total	**66**	**100%**

The sample of countries in the study also had a good variance with regards to income levels, as shown in Figure 5. This is important as aid and public expenditure may differ according to income levels of countries and this may impact on levels of observed fungibility.

Figure 5: Income Distribution of Study Sample



As shown in Table 2, lower-middle-income countries accounted for the majority of the sample (41%) with the remainder equally shared by low- and high-income countries.

Table 2: Income Distribution of Study Sample (Frequency)

Income Group	Frequency	Percentage
Low-income	20	30%
Lower-Middle-income	27	41%
Upper -Middle-income	19	29%
Total	**66**	**100%**

4.2 Descriptive Analysis Results

4.2.1 Agricultural Output

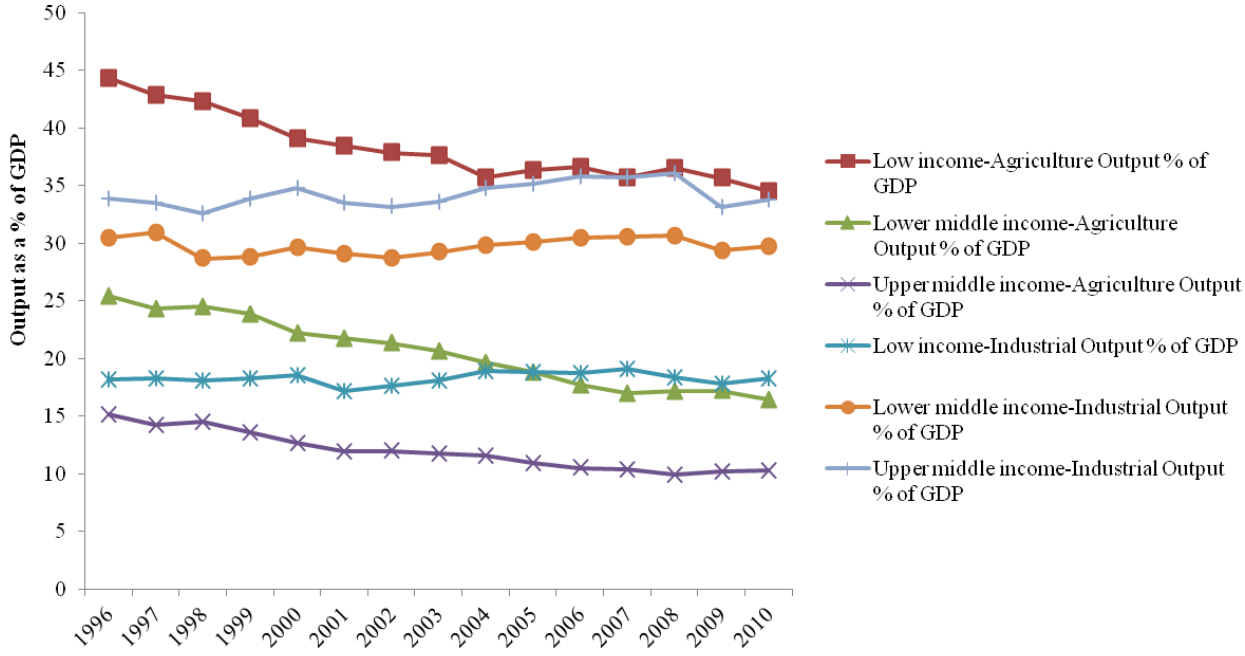
Table 3 presents the average agricultural and industrial output for low, lower-middle, and upper-middle-income countries for 1996-2010. Low-income countries had the highest share of agriculture in GDP accounting for 38.2% of GDP followed by lower-middle and upper-middle-income countries with 20.5% and 12.0% respectively.

Table 3: Average Sector output as a Percentage of GDP 1996-2010

Country income level	Agriculture (%)	Industry (%)
Low-income	38.2	18.9
Lower-Middle-income	20.5	29.8
Upper -Middle-income	12.0	34.2

Despite the large contribution of agriculture to GDP in low-income countries, we found that over time the share declined considerably between 1996 and 2010. As illustrated in Figure 6, in low-income countries agricultural output declined from 44% of GDP in 1996 to 34% in 2010. Similarly, agricultural output as a share of GDP in lower-middle and upper-middle countries fell by 9% and 5% respectively over the study period.

Figure 6: Agricultural verses Industrial Output (as a percentage of GDP)



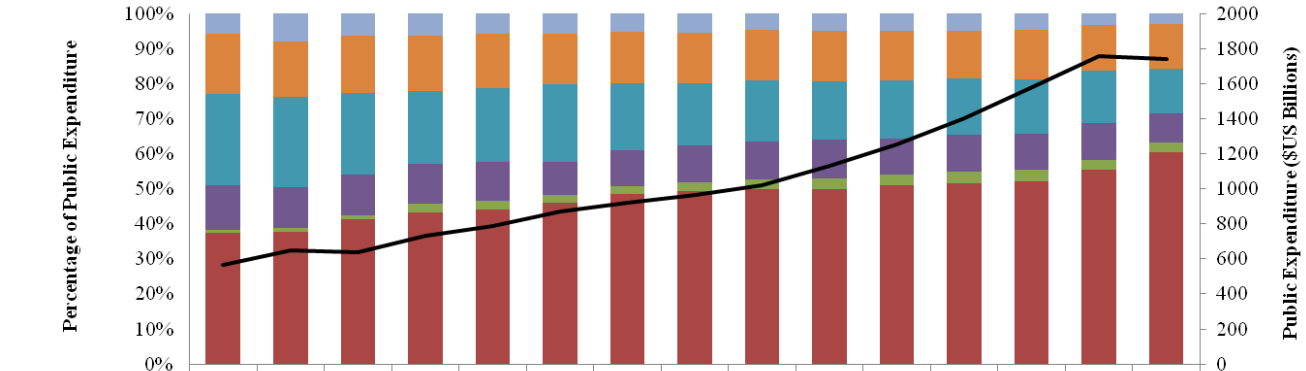
By contrast, industrial output as a share of GDP has increased or remained constant over this time period. As indicated in Table 3, upper-middle-income countries had the largest share industrial output which on average accounted for 34% of GDP, followed by lower-middle-income countries and low-income countries in which industrial output accounted for 19% and 30% of national income respectively. Growth in the industrial sector as a share of GDP was higher in upper-middle-income countries (3%) relative to low-income countries where industrial output remained largely stagnant.

4.3 Composition and Trends for Government Expenditure and Revenues

4.3.1 Total Government Expenditure

During the period 1996-2010, in absolute terms total government expenditure across low- and middle-income countries increased by approximately 2.1 times to $ US 1.7 trillion in 2010 (Figure 7). However, the increase in public expenditure was largely driven by increases in public expenditure from the EAP region, with public expenditures in this region accounting for 37% of all public expenditures in developing countries in 1996 and increasing to 65% in 2010. The ECA region experienced a slight increase in public expenditure, increasing its 1% share of total public expenditure in developing countries in 1996 to 3% in 2010. In contrast, other regions have decreased their share of total public expenditure, including MENA, SSA, LAC, and South Asia regions, each decreasing their contribution to total developing country public expenditure by 51%, 48%, 34%, and 26% respectively.

Figure 7: Trend in Total Government Expenditures (1996-2010)



	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
SSA	6%	8%	6%	6%	6%	6%	5%	6%	5%	5%	5%	5%	4%	3%	3%
SOUTH ASIA	17%	16%	16%	16%	15%	14%	15%	14%	14%	14%	14%	13%	14%	13%	13%
MENA	26%	26%	23%	21%	21%	22%	19%	18%	17%	17%	16%	16%	15%	15%	13%
LAC	13%	12%	12%	11%	11%	10%	10%	10%	11%	11%	10%	10%	10%	10%	8%
ECA	1%	1%	1%	2%	2%	2%	2%	2%	3%	3%	3%	3%	3%	3%	3%
EAP	37%	38%	41%	43%	44%	46%	49%	49%	50%	50%	51%	52%	52%	56%	60%
Total Expenditure	567.89	647.99	639.66	730.38	787.87	869.23	919.45	966.28	1023.24	1133.45	1254.98	1402.58	1580.51	1756.98	1744.04

As illustrated Table 4, during 1996-2000 total government expenditures across developing countries was spent on recurrent expense items. However, from 1996 to 2010 the share of capital expenditures as a fraction of total government expenditures increased by 3% from 1996 levels to account for an average of 49.9% of total government expenditure between 2008 and 2010.

Table 4: Composition of Government Expenditure (capital verse recurrent)

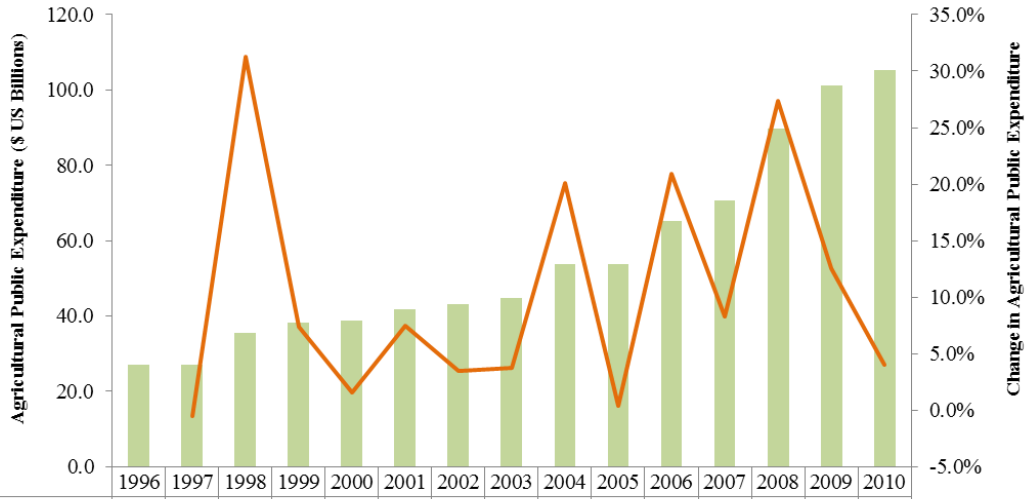
Year	1996-1998	1999-2001	2002-2004	2005-2007	2008-2010
Recurrent Expenditure	53.9%	54.6%	52.5%	51.0%	50.1%
Capital Expenditure	46.1%	45.4%	47.5%	49.0%	49.9%
Total Government Expenditure	100.0%	100.0%	100.0%	100.0%	100.0%

4.3.2 Public Expenditure to Agriculture

As indicated in Figure 8 the study found that for developing countries total public expenditures to agriculture during the period 1996 to 2010 amounted to $ US 835.5 billion. Although in absolute terms public expenditures in the agriculture sector nearly tripled from 1996 to 2010 the annual change in expenditures appears to have been erratic over time. For instance, there was a slight annual decrease of public expenditures to agriculture from 1996 to 1997 of 0.5% to $US 27.1 billion. Going forward from 1997 to 2006, year on year changes in real expenditures in agriculture increased substantially, with 2006 exhibiting the highest positive

expenditure change of 21% from 2005 levels to $ US 65.2 Billion. However, from 2006 to 2009 the absolute amount of public expenditure in agriculture decreased by 12.5% and then decreased by 4% in 2010 expenditures of $ US 105.1 billion.

Figure 8: Agricultural Public Expenditures (1996-2010)



	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Public Expenditure ($ US Billions)	27.2	27.1	35.5	38.1	38.8	41.7	43.1	44.7	53.7	53.9	65.2	70.5	89.8	101.1	105.1
Percentage Increase		-0.5%	31.3%	7.4%	1.6%	7.5%	3.5%	3.8%	20.1%	0.4%	20.9%	8.2%	27.3%	12.5%	4.0%

Despite the increase in public expenditures on agriculture in real terms, its share in total government expenditures failed to increase over the study period (see Figure 9). The share of public expenditures to agriculture in total public expenditures deviated slightly from its of average 5.1% over the study period, peaking at 6% in 2006 and being at its lowest of 4.2%.in 2007. In comparison to other sectors, agriculture as a portion of all public expenditures has remained stagnant. By contrast, the share of public expenditures to social protection, mining, transport and communications as a proportion of total public expenditures increased by 4.2%, 1.4%, and 2% respectively.

Figure 9: Sectoral Composition of Public Expenditure (1996-2010

	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Recurrent Expenditure	54.4%	54.1%	53.2%	53.0%	54.5%	56.4%	53.8%	52.9%	50.8%	51.7%	51.1%	50.3%	52.3%	48.2%	49.7%
Communication	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
Defence	10.2%	9.9%	9.7%	9.7%	8.7%	8.2%	8.2%	8.2%	8.4%	7.9%	7.8%	7.4%	6.6%	6.5%	6.1%
Mining	0.8%	0.7%	0.6%	0.6%	0.7%	0.8%	0.9%	0.8%	0.8%	0.8%	0.9%	0.8%	0.5%	2.0%	2.3%
Transport	2.7%	2.8%	2.5%	2.1%	1.8%	1.5%	2.1%	2.4%	2.6%	2.4%	2.3%	4.0%	3.9%	4.9%	4.7%
Health	4.6%	4.8%	4.8%	4.7%	4.6%	4.5%	4.7%	5.0%	5.1%	5.0%	5.1%	4.7%	4.6%	5.0%	4.6%
Transport and Communication	3.5%	3.5%	3.1%	2.7%	2.5%	2.1%	2.4%	2.7%	2.9%	2.9%	2.8%	4.5%	4.2%	5.2%	5.0%
Agriculture	4.8%	4.2%	5.6%	5.2%	4.9%	4.8%	4.7%	4.6%	5.2%	4.8%	5.2%	5.0%	5.7%	5.8%	6.0%
Social Protection	5.7%	7.1%	6.8%	8.4%	8.8%	8.8%	9.7%	9.6%	10.3%	10.8%	11.0%	11.3%	10.7%	10.8%	9.9%
Education	13.1%	12.9%	13.6%	13.4%	13.4%	12.8%	13.5%	13.6%	13.6%	13.5%	13.7%	11.9%	11.4%	11.5%	11.7%

As illustrated in Table 5 there are regional differences in the share of agriculture in public expenditure. For instance the EAP in comparison to other regions agriculture on average has the highest share of agriculture expenditures as a portion of public expenditure with 7%. The EAP region is followed in descending order by South Asia, SSA, ECA, MENA and LAC regions with agriculture on average accounting for 5.3%, 4.7%, 3.5%, 2.9% and 1.1% of total government expenditures between 1996 and 2010.

Table 5: Agricultural Public Expenditures verses Agricultural Output (1996-2010)

Region	**Share of Agricultural Output in GDP**					**Share of Agriculture in Total Expenditure**				
	1996/8	**1999/01**	**2002/04**	**2005/07**	**2008/10**	**1996/8**	**1999/01**	**2002/04**	**2005/07**	**2008/10**
EAP	20.4%	18.6%	16.7%	15.4%	15.3%	8.0%	6.7%	6.6%	6.4%	7.4%
ECA	28.1%	24.0%	20.0%	16.2%	12.9%	6.5%	3.6%	4.5%	0.2%	2.8%
LAC	12.8%	10.7%	10.2%	9.6%	9.4%	1.3%	1.3%	0.8%	0.9%	1.2%
MENA	15.1%	13.2%	12.9%	11.4%	11.0%	2.0%	3.6%	3.5%	3.7%	1.7%
SOUTH ASIA	28.6%	26.9%	25.3%	22.7%	22.0%	4.6%	4.7%	3.9%	5.4%	7.6%
SSA	35.7%	32.9%	31.4%	29.9%	29.5%	3.8%	5.1%	4.3%	4.9%	5.2%
Total	**27.4%**	**24.7%**	**23.0%**	**21.3%**	**20.6%**	**4.4%**	**4.2%**	**3.9%**	**3.6%**	**4.3%**

The study also found significant differences between the rate of change in public expenditures and agricultural output. For example, in sub-Saharan Africa between 1996 and 2010, agriculture's share of GDP decreased by 6% as compared to the slight increase of 1% in public expenditures in the sector. In other regions public expenditures as well as agricultural output decreased over time albeit at different rates. For example, the ECA region experienced the most considerable decline in the share of total spending to agriculture with a decline of nearly 4% percent of total government expenditures. The ECA region also experienced an even larger decrease in agricultural output from contributing 28% to GDP in 1996 to 12.9% in 2010.

4.3.3 Government Revenues

For the purposes of this paper we focused on analysing the tax revenue and ODA components of total government revenues. Thus, public debt and other non-ODA or non-tax revenues were excluded from the analysis and therefore are not presented in these results. In section 4.3.4 total and agriculture aid flows are discussed in further detail.

For the period 1996 to 2010, in low- and middle-income countries tax revenues accounted for an average of 16% of total GDP, whilst ODA accounted for 14% of total GDP. Table 6 shows annual figures for tax revenues and ODA as a percentage of GDP, disaggregated by income group.

Table 6: Total ODA verses Tax Revenues (1996-2010)

Year	ODA as a % GDP			Tax Revenue as a %GDP		
	Low-income	Lower-middle-income	Upper-middle-income	Low-income	Lower-middle-income	Upper-middle-income
1996	10%	4%	2%	13%	16%	19%
1997	10%	4%	2%	14%	16%	19%
1998	19%	8%	3%	11%	14%	19%
1999	12%	6%	3%	11%	14%	20%
2000	10%	3%	2%	12%	14%	22%
2001	8%	4%	2%	11%	14%	21%
2002	20%	7%	4%	11%	14%	18%
2003	18%	6%	3%	11%	14%	17%
2004	18%	6%	2%	12%	15%	19%
2005	15%	6%	1%	12%	16%	19%
2006	16%	6%	2%	12%	17%	22%
2007	21%	5%	3%	12%	17%	21%
2008	22%	6%	2%	12%	18%	22%
2009	195%	55%	15%	12%	14%	19%
2010	39%	12%	6%	13%	15%	19%

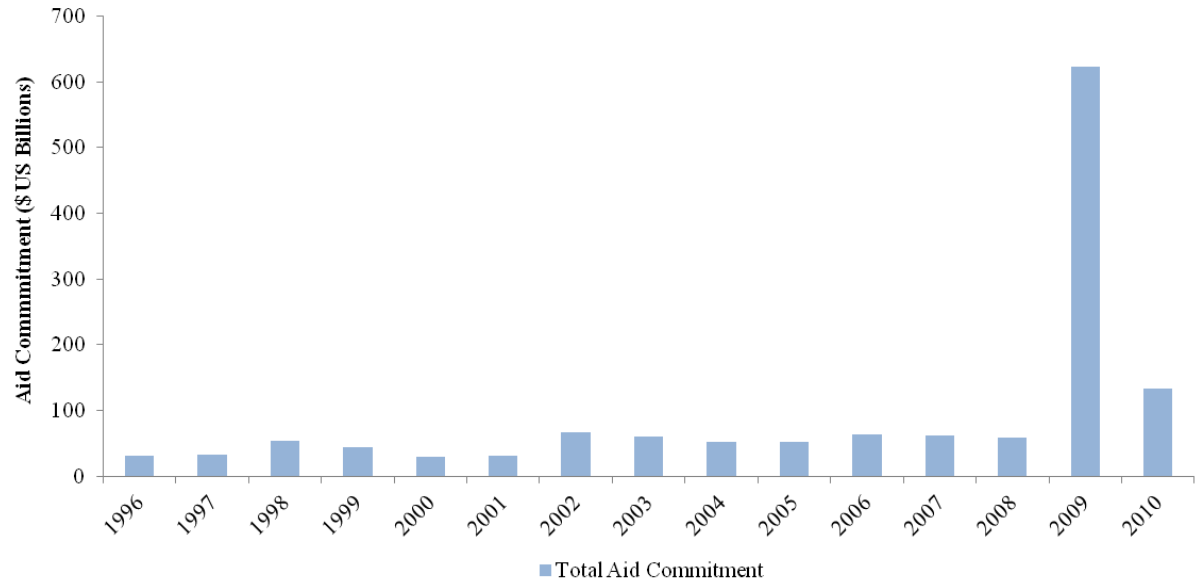
As illustrated in Table 6, low-income countries have the highest shares of ODA in GDP with an average of 29% as compared to 9% and 3% for lower-middle and upper-middle-income countries respectively. Across all income groups, there appears to be an increase in ODA during the study period, with a notable increase in 2009 in which ODA increased by multiples of 8.86, 9.16, and 7.5 for low-income, lower-middle and upper-middle-income countries respectively. It appears that the 2009 increase in aid levels was due to unexpected shocks as aid revenue decreased significantly the following year.

In order of descending magnitude, tax revenue accounted an average of 12%, 15% and 20% of GDP in upper-middle, lower-middle and low-income countries respectively over 1996-2010. Unlike ODA, tax revenue over the study period has largely been stagnant with only slight deviations about observed averages across income groups. Even in 2009, when ODA across all income groups increased by an average of 705%, tax revenues increased by only 16%.

4.3.3.1 Trend of Aid Commitments (1996-2010)

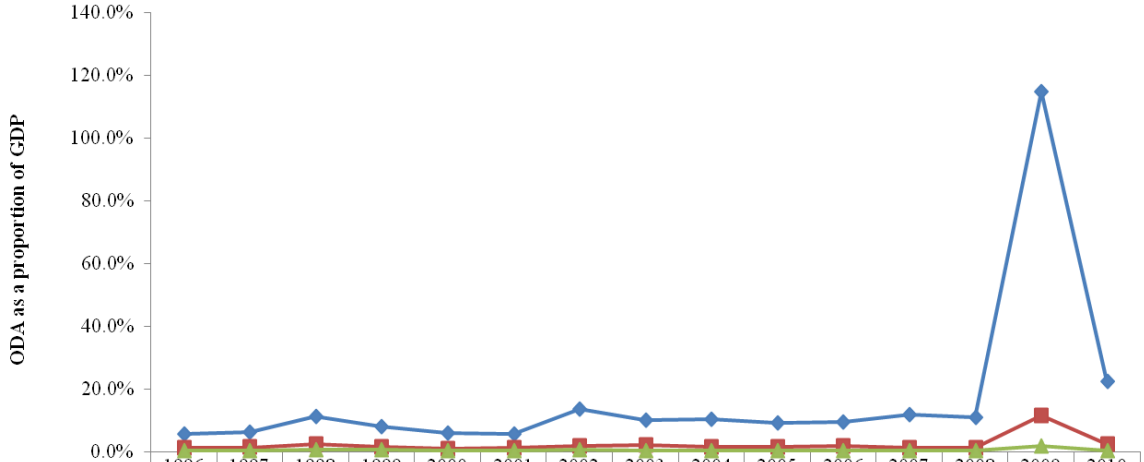
From 1996 total aid to low- and middle-income countries increased by 24.5% to $ US 133.5 billion in 2010. Between 1996 and 2008 aid commitments grew at an average of 11% and then spiked significantly to 960% between 2008 and 2009 (Figure 10). This is probably due to the recommitment of donors toward poverty alleviation and food security following the 2007/2008 food crisis.

Figure 10Total Aid Commitments (1996-2010):



When the composition of aid flows were broken down by income group and geographic region, the study found that low-income groups and the sub-Saharan region received an increasing majority of aid. As illustrated in Figure 11, over 1996-2010 ODA accounted for a significant proportion of national income in low-income countries as compared to lower-middle and upper-middle-income countries. Specifically, on average ODA accounted for 18% of total GDP in low-income countries as compared to 2% and 0.5% in lower-middle-income and upper-middle-income countries respectively. This is especially apparent in 2009 whereby in line with ODA commitment surge the amount of ODA received in low-income as a portion of GDP was 115% which was a marked increase from the previous year whereby ODA accounted for 11% of GDP.

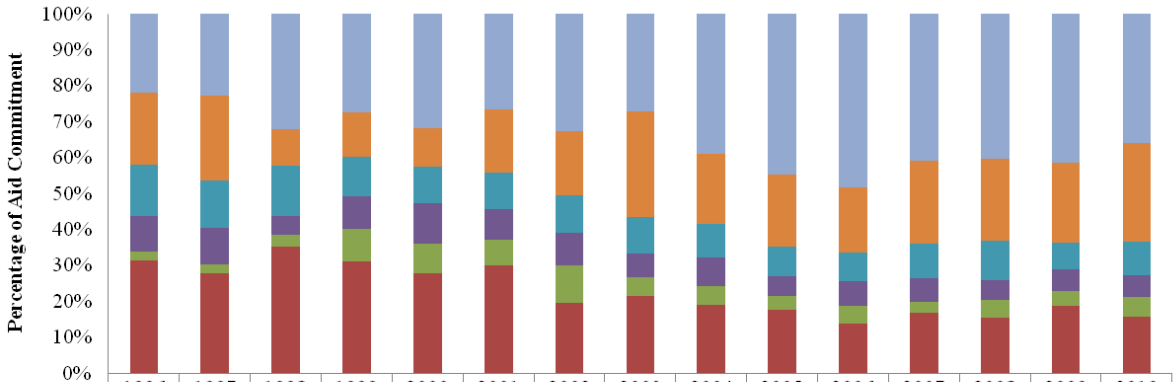
Figure 11: ODA as a share of GDP across different income groups



	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Low Income	5.6%	6.2%	11.2%	8.0%	6.0%	5.6%	13.4%	10.1%	10.2%	9.0%	9.4%	11.8%	10.9%	114.8%	22.3%
Lower middle income	1.3%	1.3%	2.3%	1.5%	0.9%	1.1%	1.9%	1.9%	1.4%	1.4%	1.7%	1.3%	1.1%	11.6%	2.3%
Upper Middle Income	0.4%	0.4%	0.5%	0.6%	0.4%	0.3%	0.6%	0.4%	0.3%	0.3%	0.3%	0.2%	0.2%	1.7%	0.4%

As illustrated in Figure 12 the regional distribution of ODA recipients appears to have shifted over the study period. This can be seen in trends of the share of ODA to the EAP region which reduced by 50% during 1996-2010, whereby in 1996 EAP accounted for the largest share of ODA flows at 31% and has subsequently reduced its share of ODA flows to 16%. Similarly, flows of ODA to the LAC and MENA regions decreased from 1996 to 2010, with the change in shares of ODA flows to these regions decreasing by 38% and 35% respectively. In contrast, the shares of ODA to the sub-Saharan and ECA region increased significantly. The share of total aid to SSA increased from 22% in 1996 to 36% in 2010, whilst the share of aid to ECA increased from 2% to 5% in 2010.

Figure 12: Distribution of ODA across various regions (1996-2010)

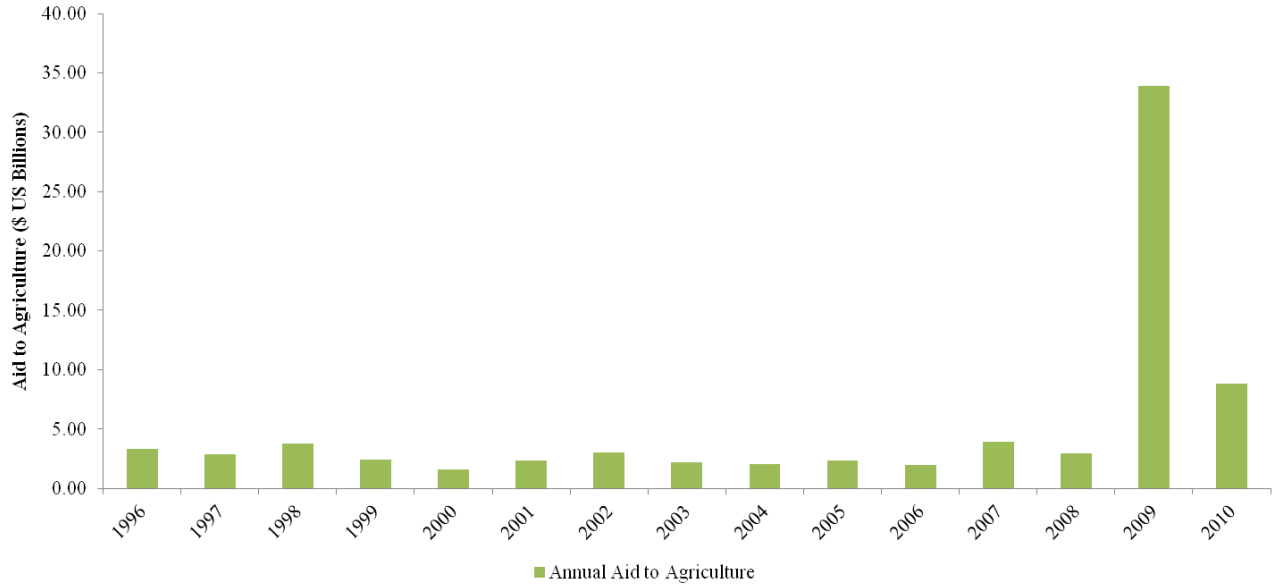


	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
SSA	22%	23%	32%	27%	32%	27%	33%	27%	39%	45%	48%	41%	40%	41%	36%
SOUTH ASIA	20%	24%	10%	12%	11%	17%	18%	29%	20%	20%	18%	23%	23%	22%	28%
MENA	14%	13%	14%	11%	10%	10%	11%	10%	9%	8%	8%	10%	11%	7%	9%
LAC	10%	10%	5%	9%	11%	9%	9%	7%	8%	6%	7%	7%	6%	6%	6%
ECA	2%	2%	3%	9%	8%	7%	10%	5%	5%	4%	5%	3%	5%	4%	5%
EAP	31%	28%	35%	31%	28%	30%	20%	22%	19%	18%	14%	17%	15%	19%	16%

4.3.3.2 Trend of Aid to Agriculture (1996-2010)

A illustrated in Figure 13, by 2010 aid to agriculture increased significantly from 1996 levels, with aid flows increasing by 162% to $US 8 795 072 287.33. However, the increase in aid to 2010 levels has been marked by erratic changes in volumes during the period under review. More specifically, the three year average of change in the volume of aid commitments to agriculture decreased by 6% during 1996-1999, increased by 13% during 2000-2002; decreased by 7% between 2003 -2005; and then increased again by19% in between 2006-2008. Most notable, is the significant surge of aid to agriculture in 2009 of 1043% from 2008 to $US 33 913 436 011.69 which was proceeded by decrease in the proceeding year by 74% which was still higher than pre-2009 levels by 196%.

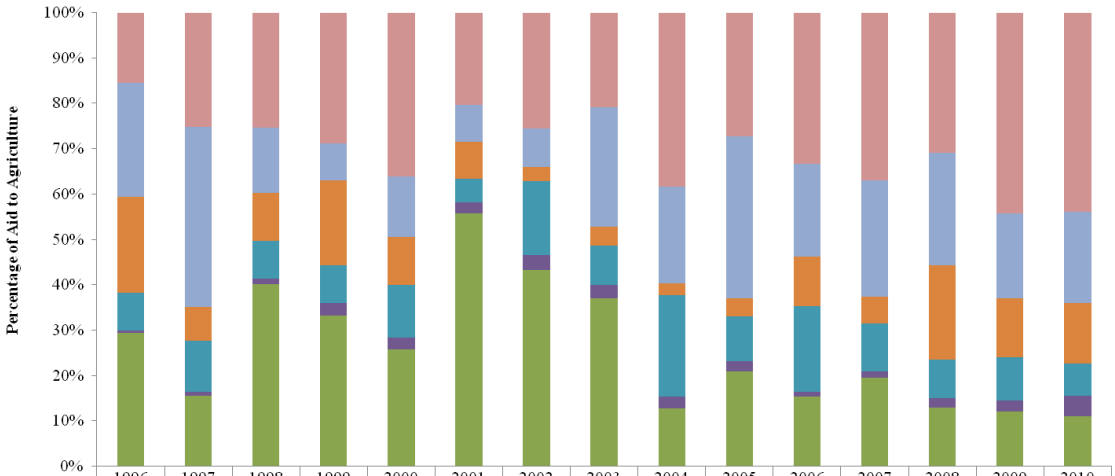
Figure 13: Total Aid Commitments to Agriculture (1996-2010)



Over and above the increase in the sheer volume of aid to agriculture during the period 1996-2010 there appears to be a change in the distribution, composition, modality as well as donors of aid to agriculture.

As depicted in Figure 14, the distribution of aid across regions has changed with sub-Saharan Africa receiving the majority of aid to agriculture in 2010 whereas previously in 1996 the majority of aid to agriculture was given to the EAP region. More specifically, sub-Saharan has experienced the highest increase in aid to agriculture, as can be seen in 1996 where it accounted for only 15.6% of aid flows to agriculture which significantly increased to 43.9% by 2010. In the same vain, increasingly aid to agriculture has been targeted to the ECA region with its portion of aid flows to agriculture increasing to 4.5% in 2010 from 0.5% in 1996. In contrast, aid flows to agriculture have decreased in other regions most notably the fraction of aid to agriculture destined for the EAP region has decreased by 62% from 1996 to 11.1% in 2010. Similarly, aid flows to the LAC, South Asia and MENA decreased from 1996 levels with the proportion of aid to these regions decreasing by 15%, 20% and 37% respectively.

Figure 14: Distribution of Aid to Agriculture across various regions

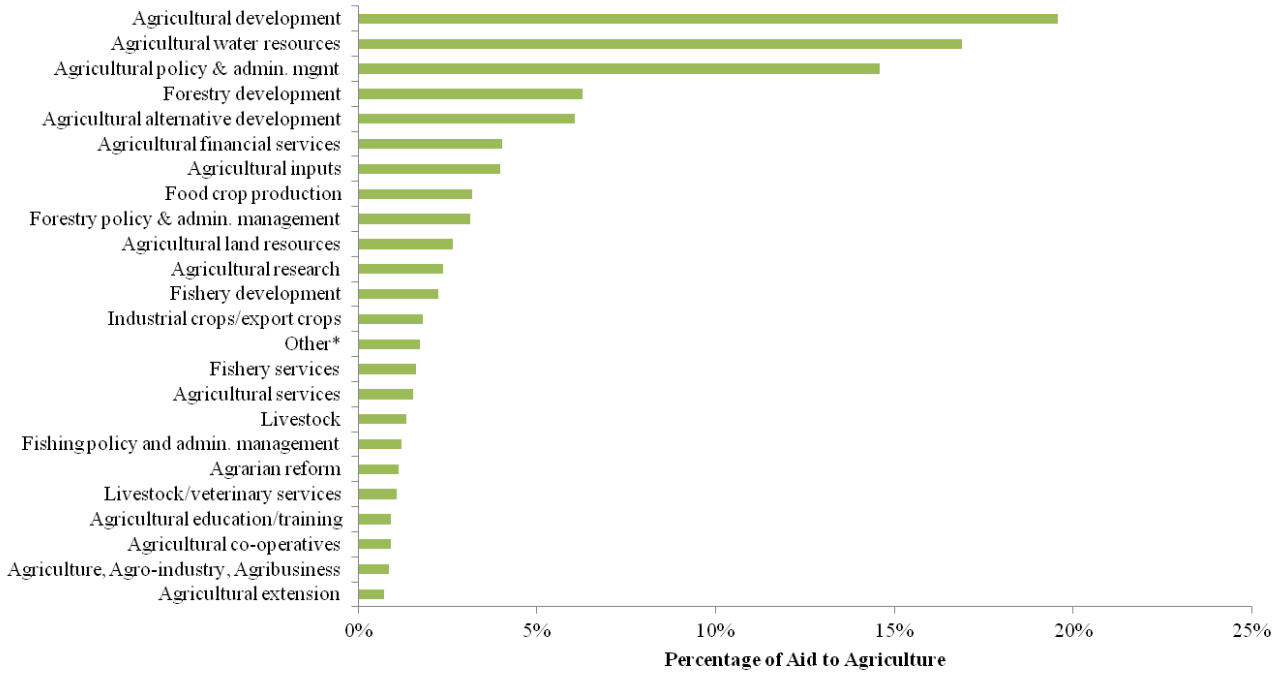


	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
SSA	15.6%	25.2%	25.4%	28.8%	36.2%	20.3%	25.5%	20.9%	38.3%	27.3%	33.3%	37.0%	31.0%	44.3%	43.9%
SOUTH ASIA	25.0%	39.6%	14.3%	8.1%	13.3%	8.1%	8.5%	26.3%	21.3%	35.8%	20.5%	25.7%	24.7%	18.7%	20.1%
MENA	21.1%	7.5%	10.7%	18.7%	10.5%	8.1%	3.2%	4.1%	2.6%	3.9%	11.0%	5.9%	20.7%	13.0%	13.3%
LAC	8.4%	11.2%	8.2%	8.3%	11.6%	5.2%	16.3%	8.6%	22.3%	9.9%	18.9%	10.6%	8.6%	9.5%	7.1%
ECA	0.5%	1.0%	1.4%	2.8%	2.6%	2.4%	3.3%	3.1%	2.6%	2.2%	1.0%	1.3%	2.1%	2.5%	4.5%
EAP	29.4%	15.5%	40.1%	33.2%	25.8%	55.7%	43.3%	37.0%	12.8%	21.0%	15.3%	19.6%	12.9%	12.0%	11.1%

When disaggregating aid to agriculture by purpose, the study found that in the period 1996-2010, agricultural policy and administration management, agricultural water resources and agricultural development accounted for the majority of aid to agriculture (see Figure 15). Agricultural policy and administration management, agricultural water resources and agricultural development collectively contributed 51% of aid to agriculture with each accounting for 15%, 17% and 20% respectively. However, as indicated in Appendix D, the composition of agricultural aid changed, signalling the shifting ideology of donors in so far as to how they enable agricultural development. Although aid to water sources contributes a significant portion of total aid to agriculture over the 14 years under review, its share year on year has declined whereby on average between 1996 and 1998 it accounted for 25% of aid to agriculture however by 2010 this portion decreased to 16% of total aid to agriculture. Other agricultural areas that received a reduction in aid include agricultural inputs, financial services as well as a majority of slows to the fisheries and forestry sub-sectors. Agricultural development which includes aid intended for integrated projects and farm development had the highest increase in the share of aid to agriculture .Agricultural development accounted on average 8% of aid flows to agriculture between1996-1998 and increased significantly to account for 22% between 2008-2010. Similarly, aid flows to agricultural alternative development which funds the reduction of illicit drug cultivation through other agricultural marketing and production opportunities (e.g. cultivation of poppy for heroin) increased significantly. This is especially apparent for countries that have high illicit drug cultivation and

commercialisation such as Afghanistan and Columbia which collectively accounted for an average of 70% of aid flows to agricultural alternative development between 2008 and 2010.

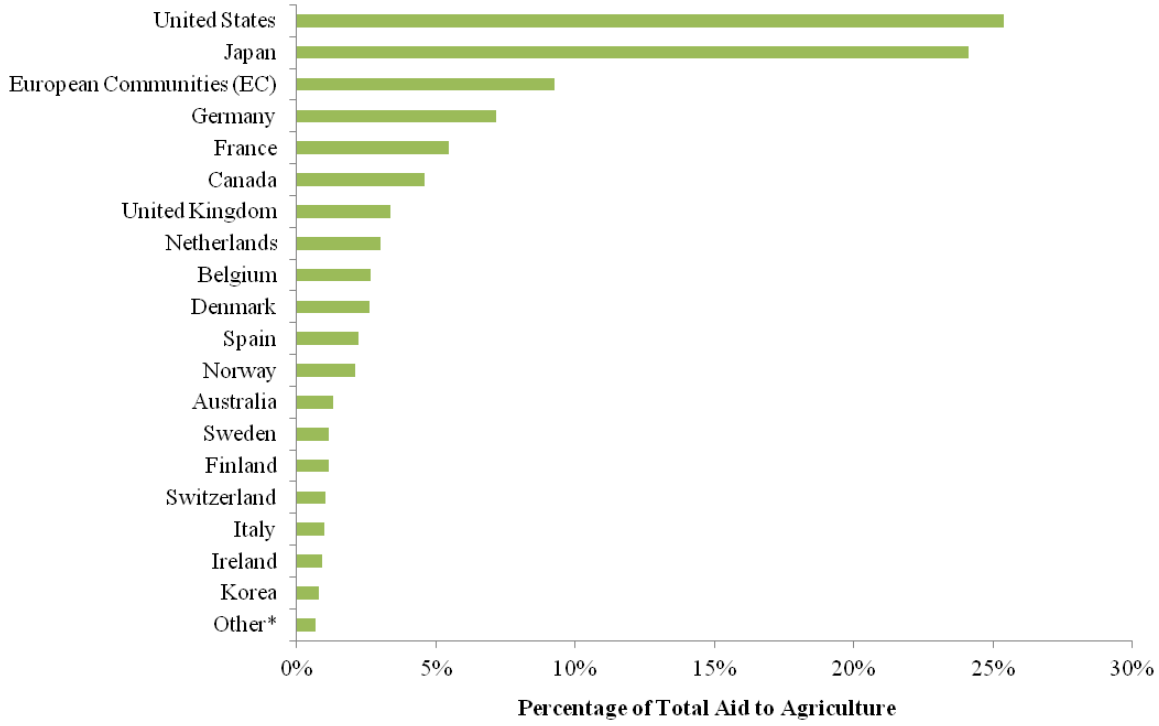
Figure 15: Composition of Aid to Agriculture by Purpose (% of Total Aid to Agriculture)



*Other comprises of all purpose codes whose individual percentage is less than 1%, namely Forestry, purpose unspecified or does not fit under any other applicable codes; Agriculture, combination of purposes in Agriculture, Forestry, Fishing; Fishing policy and administrative management; Forestry policy and administrative management; Agriculture, purpose unspecified or does not fit under any other applicable codes; Agricultural services, purpose; Forestry education/training; Forestry research; Fuel wood/charcoal; Agricultural policy and administrative management; Forestry services; Fishery research; Fishery education/training; Plant/post-harvest prot. & pest ctrl

As illustrated in Figure 16, in the period 1996-2010 the largest donors of aid to agriculture have been the United States, Japan, European Communities (EC) and Germany which collectively accounted for two thirds of total aid to agriculture. However, as indicated in Appendix E when looking at the year on year changes in donor commitments the study found that some donors over time changed their commitments to agriculture. For example, United States exhibited a significant increase in their share of commitment to aid to agriculture (from 2.8% in 1996 to 32.5% in 2010) much like the EC (from 2.5% in 1996 to 13.7% in 2010). In contrast Japan's contribution to aid to agriculture over time decreased from 65% in 1996 to 13% in 2010.

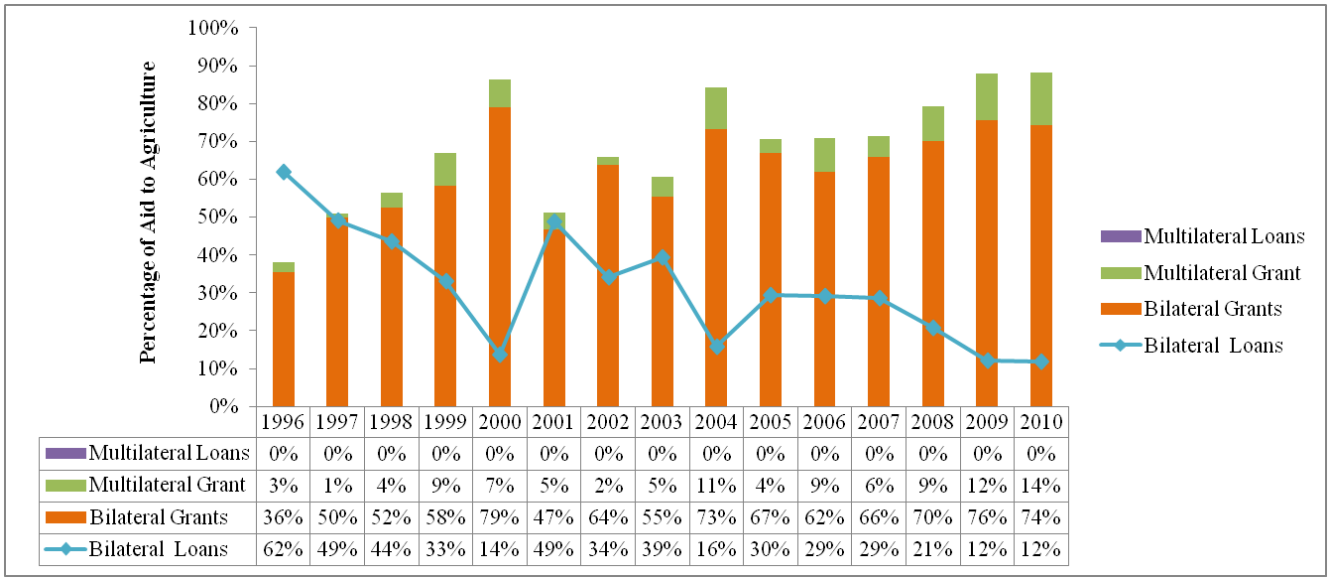
Figure 16: Composition of Aid to Agriculture by Donor (% of Total Aid to Agriculture)



*Other comprises of all donors whose individual percentage is less than 1%, namely World Food Program (WFP); United Nations Peacebuilding Fund (UNPBF);Greece; Portugal; New Zealand; United Nations Development Programme (UNDP); Luxembourg; Austria

Figure 17 presents trends of agricultural aid according to their composition (grant verses loan). Increasingly over the period 1996-2010 the modality of choice for administering aid to agriculture amongst donors was grants, in particular bilateral grants. Whilst bilateral grants accounted for 36% of total aid to agriculture in 1996 they increased to 74% by end of 2010 and peaked at 76% in 2009. Similarly, multilateral grants increased from accounting for 3% of total aid to 12 % in 2010. In contrast, aid in the form of loans decreased over time with bilateral loans decreasing from accounting for 62% of total aid in 1996 to 12% in 2010 whilst aid to agriculture was never distributed as multilateral loans over the period 1996-2010.

Figure 17: Composition of Aid to Agriculture by Modality (% of Total Aid to Agriculture)



	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Multilateral Loans	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Multilateral Grant	3%	1%	4%	9%	7%	5%	2%	5%	11%	4%	9%	6%	9%	12%	14%
Bilateral Grants	36%	50%	52%	58%	79%	47%	64%	55%	73%	67%	62%	66%	70%	76%	74%
Bilateral Loans	62%	49%	44%	33%	14%	49%	34%	39%	16%	30%	29%	29%	21%	12%	12%

4.4 Empirical Analysis Results

4.4.1 Fungibility Study Results

We firstly present the results of the regression diagnostics tests were conducted prior to the fungibility analysis. The results were used to assess if the extent to which data met regression assumptions and in so doing finalise which panel regression model would be suitable based on the characteristics of the data.

A preliminary panel regression analysis was run with all model variables and error variables tested. Using the Dikey Fuller Test, results concluded that the hypothesis that error terms are non-stationary could be rejected. More specifically, the t-statistic of -6.4930 significant at p<.0010 was less than the critical values of the Dickey-Fuller test (-3.12 -3.41 -3.96 at 1%, 5% and 10% significant level, respectively), therefore indicating that the data did not exhibit a unit root problem and the panel data series was stationary. Although, the data did not violate the assumption of stationarity, diagnostic testing found that there was a need to correct or account for the presence of heteroscedasticity and autocorrelation in error terms as well as non linearity between dependent and independent variables.

Observations of partial regression plots of dependent against independent variables revealed a non linear relationship. Appendix F shows the regression plots after the variables were log transformed and indicate that the log transformations to correct for observed non linearity was

successful. Given the observed non-linearity of the data the independent and dependent variables were log-transformed. Once log transformed, linearity was observed.

The Durbin Watson test which was used to check for the presence of autocorrelation in each country's time series data was found to be significant. The first order Durbin –Watson of .9913 (<2) was highly significant (p<.0001) as such the null hypothesis for the existence of no first order autocorrelation in the panel of countries was rejected. As suggested by previous fungibility studies (Feyzioglu, Swaroop & Zhu, 1998; Fan & Rao, 2003; Affairs, 2009; Lu et al., 2010; Sijpe, 2010; Marc, 2012), the dependent variable was lagged in order to correct for autocorrelation. As per results of the Lagrange Multiplier test, there was also strong evidence of ARCH effects (p-value <0.0001).

In order to account for the inclusion of a lagged regress in the model a dynamic panel data model needed to be used. In addition, the chosen dynamic panel data model would need to also account for the presence of heteroskedasticity of error variables in the data as well as potential endogeneity bias from the correlation between aid to agriculture and error terms of public expenditure (i.e. relax strict exogeneity assumption) .In this regard, the Arellano-Bover/Blundell-Bond linear generalised method of moments (GMM) estimators was used. This particular model is designed for micro panel data, which contains many panels and few time periods and prevents endogeneity bias by accounting for the presence of heteroskedasticity (allowing for use of lagged variables) and autocorrelation of error terms within panels (Bond, 2002).

Taking into account the transformation of independent variables and lagging of the dependent variable the fungibility model described in section 3.4.1 was adjusted and the following model was estimated:

$$\mathbf{InAGE_t = \beta_{0AG} + InAGE_{t-1} + In\beta_{1AG}GDP_t + In\beta_{2AG}AAG_t + In\beta_{3AG}G + In\beta_{4AG}EMG_t + {}_{+}\mathcal{E}_{AG}}$$

where,

AGE_t = Log of per capita public expenditures to agriculture

AGE_{t-1}= 1 year Lagged per capita public expenditures to agriculture

GDP_t = Log of per capita GDP

AAG_t = Log of per capita aid to agriculture

EMG_t = Log of emergency food aid

Table 7 presents aggregate fungibility results for a sample of 605 observations consisting of time series data from 1996 to 2010. Although the full data set covers 66 countries, due to missing data the study run fungibility analysis on a subset of the full sample which consists of countries that at minimum had two full years of cross sectional data. Therefore, in addition to removing influential data observations, Zimbabwe, Mali and Sudan were removed from the analysis leading to only 63 countries being included in the regression analysis.

Table 7: Main Fungibility Study Panel Regression Results (1996-2010)

Variable	Estimate	p value
Log of ODA to agriculture per capita	0.032964	<.0001
Log of GDP per capita	-0.89304	<.0001
Food aid	0.120201	0.0001
Log of Governance	0.16474	0.0066
Number of Countries	63	

Given the log-log specification of the fungibility model, the coefficient of independent variables presented in Table 7 are partial elasticity estimates to the dependent variable. That is, the coefficients indicate the percentage change of public agriculture expenditure given a percentage change in an independent variable holding all other independent variables constant.

Table 7 shows a positive and statistically significant relationship between agricultural public spending per capita and the per capita net ODA commitments to agriculture, where the null hypothesis of no fungibility is strongly rejected ($p<.0001$). However the small positive coefficient indicates evidence of near full fungibility of agricultural aid whereby an increase in donor funding leads to a less than proportionate increase in public expenditure in agriculture. More specifically, in low- and middle-income countries, a one percent increase in donor funding for agriculture leads to a mere .03% increase in public spending in the sector, independent of changes in GDP per capita, quality of governance as well as country and year -specific effects. As expected, GDP per capita is conversely related to government agriculture expenditures. The study found that collectively for low- and middle-income countries, a 1 percent increase in GDP per capita resulted in a decrease of .89 percent in agricultural public expenditures, holding all else constant. In addition, the relationship between public

expenditures and governance was found to be significantly positive, with a one percent increment in the corruption index leading to a .16% increase in public expenditures.

The study included two sub analyses that aimed to test if the relationship between aid and public expenditure differed according to income group and quality of institutional governance.

To examine if differences existed between countries according to income levels, the sample of 63 countries were split into two main groups, the first included low- and lower-middle-income countries (GDP per capita of no more than $3,975 in 2010) and the second upper-middle-income countries (GDP per capita of no more than $12,275 in 2010).The results are reported in Table 8 and contain model estimates for a group of 44 low- and lower-middle-income countries and another group of 19 upper-middle-income countries. Results of the sub analysis indicated that coefficient estimates differed for the different income groups. However, given that the sample for upper-middle-income countries was quite small the model was limited in its explanatory power. The positive relationship between aid and public expenditure to agriculture was consistent in both income groups, with the magnitude of the coefficient being similar. This is to say, low- and middle-income countries exhibited similar levels of partial fungibility with a 1% increase in aid to agriculture resulting in a .01 % and .02% increase in public expenditure respectively. The relationship between public expenditure and other model variables was significantly more pronounced and different across the different income group. For instance, a 1% increase in GDP per capita in the upper-middle-income group led to a more than proportionate decrease in public expenditure of 1.12% as compared to the other income group where a similar increase in GDP capita led to 0.63% in public expenditure reduced.

Table 8: Fungibility sub Analysis (by Income Group) Results (1996-2010)

	Low and Lower-middle-income Countries		Upper-middle-income Countries	
Variable	**Estimate**	**p value**	**Estimate**	**p value**
Log of ODA to agriculture per capita	0.014929	0.0149	0.023561	0.3037
Log of GDP per capita	-0.63981	0.0002	-1.13352	0.2442
Food aid	0.450485	<.0001	0.020238	0.8307
Log of Governance	0.582919	<.0001	-0.40708	0.1789
Number of Countries	44		19	

The model estimated in Table 8 suggests that the effect of aid to agriculture on public expenditures in the sector can be amplified by the level of institutional quality. To test this premise further, the second sub analyses focused on investigating if fungibility would be most evident for a subset of countries identified to have low levels of institutional governance as compared to another perceived to have better governance. To do this, the full sample set of 66 countries were ranked according to their average governance index for the study period and split between the top and the bottom 50th percentile of the sample. Table 9 presents the regression results of two sub samples of countries, one with relatively poor institutional quality (governance index in the bottom 50^{th} Quantile) and the other higher institutional quality (governance index in the top 50^{th} Quantile) The results indicate the magnitude of the effect of aid on public expenditures in the agriculture sector in countries with relatively week and good quality is largely the same with both results not deviating much from the main results. This is to say, a 1% in aid to agriculture leads to 0.02% and 0.03% increase in agricultural public spending in countries with low and high institutional quality respectively. However, it must be noted that the results of fungibility for countries with relatively week institutional quality were not significant, largely due to the availability of data as can be seen by number of observations.

Table 9: Fungibility sub Analysis (by institutional quality) Results

	Lowest Half		Top Half	
Variable	**Estimate**	**p value**	**Estimate**	**p value**
Log of ODA to agriculture per capita	0.025391	0.1570	0.035378	0.00698
Log of GDP per capita	1.722783	0.0660	-0.55393	0.2461
Food aid	0.333324	<.0001	-0.01406	0.0429
Log of Governance	0.356788	0.0009	0.283358	0.0354
Number of Countries	33		30	

4.4.2 Fiscal Response Study Result

In the same vain as the fungibility results, we first present our results of the regression diagnostics tests were conducted prior to the fungibility analysis.

A preliminary panel regression analysis was run with all model variables and error variables tested. Using the Dikey Fuller Test, results concluded that the hypothesis that error terms are non-stationary could be rejected. More specifically, the t-statistic of -6.3519 significant at p<.0010 was less than the critical values of the Dickey-Fuller test (-3.12 -3.41 -3.96 at 1%, 5% and 10% significant level, respectively), therefore indicating that the data did not exhibit a unit root problem and the panel data series was stationary. However, diagnostic testing did find that residual terms were hetereskadtic and auto correlated as well as non linearity between dependent and independent variables.

Both independent and dependent variables were log transformed in order to account for the observed non linear relationship between independent and dependent variables in both partial regression plots and correlation matrix. Appendix G shows the regression plots after the variables were log transformed and indicate that the log transformations to correct for observed non linearity was successful. The Durbin Watson test statistic was found 0.428 (<2) to be significant (p <.0001), meaning that the null hypothesis for the existence of no first order autocorrelation in the panel of countries was rejected. To correct for this we lagged the dependent variable by a year. As per results of the Lagrange Multiplier test, there was also strong evidence of ARCH effects (p-value <0.0001).

Similar to the fungibility study, we relaxed the strict exogeneity assumption and instead accounted for the dynamic nature of the panel data (presence of lagged repressor). As such the Arellano-Bover/Blundell-Bond linear generalised method of moments (GMM) estimators was used especially given that the panel model used was micro panel data comprising of few time periods (15) relative to the number of panels (63).Taking into account the transformation of independent variables and lagging of the dependent variable the fungibility model described in section 3.4.2 was adjusted and the following model was estimated:

$$InT/GDP = \beta_0 + \beta_1 InAGR + \beta_2 In\ IND + \beta_3 InINCOME + \beta_4 InGRANT + \beta_5 InLOAN + \beta_6 InM + \beta_7 InX + \mathcal{E}$$

where,

T/ GDP	= tax revenue as a percentage of GDP
AGR	= Agriculture output as a percentage of GDP
IND	= Industry output as a percentage of GDP
INCOME	= GDP per capita
GRANT	= Total aid grant as a percentage of GDP
LOAN	= Total loan grant as a percentage of GDP

Given the newly revised log-log specification of the model, the coefficient of independent variables are partial elasticity estimates indicating the percentage change of tax revenue given a percentage change in an independent variable, holding all else constant.

Like the fungibility analysis, a sub set of the full sample of 66 countries was used. Due to missing time series tax data, Zimbabwe, Nigeria, Malawi, Tonga, Swaziland, Ecuador and Mozambique were removed from the analysis and a final data set of 59 countries were used.
As presented in Table 10, total ODA has a negative impact on tax revenues. In particular, a 1% increase in total aid during 1996 to 2010 led to a 0.005% decrease in tax revenues. Regression results also indicated that the other variables included in the model significantly determined tax revenues in low- and middle-income countries. For instance, increase in agriculture output led to a decrease in tax revenue of .029% in contrast, a 1% increase in industrial output led to an increase in tax revenue of 0.39%. Import and exports output both had a significant and positive impact on tax revenue. The coefficient on GDP per capita is significant but negative, with a 1% increase in GDP per capita leading to a 0.15% decrease in tax revenue.

Table 10: Main Fiscal Response Study Panel Regression Results (1996-2010)

Variable	Estimate	p value
Industry Output as a % of GDP	0.397301	<.0001
Imports as a % of GDP	0.24899	<.0001
Exports as a % of GDP	0.105533	<.0001
Total ODA as a % of GDP	-0.00536	0.0041
Agriculture Output as a % GDP	-0.29822	<.0001
GDP per capita	-0.14863	0.0369
Number of Countries	59	

When aid is disaggregated by type, the regression analysis found that where as ODA loans had a significantly positive impact on tax revenue; grants had significantly negative impact on tax revenue. More specifically, a 1% increase in ODA loans was found to increase tax revenue by .004%, whilst a similar increase in ODA grants led to a decrease in tax revenue by .01%. Trade regressors of import and export were significantly and positively related with tax revenue although the magnitude of the impact of imports was s slightly greater than for exports. This is to say, holding all else constant a 1 percent increase in import leads to an increase in tax revenue by .16% in comparison to a .14% increase in tax revenue due to an equal increase in export output. As expected, economic structure appears to have a statistically significant impact on tax revenue. In particular, a 1 % increase in agricultural output led to a 0.22% decrease in tax revenue whilst an increase in output from the industrial sector led to an increase in tax revenue of 0.39%. The coefficient on GDP per capita is significant but negative, with a 1% increase in GDP per Capita leading to a 0.1% decrease in tax revenue.

Table 11: Fiscal Response sub Analysis (by disaggregated aid) Results (1996-2010)

Variable	Estimate	p value
Industry Output as a % of GDP	0.399802	<.0001
Imports as a % of GDP	0.157212	<.0001
Exports as a % of GDP	0.14292	<.0001
ODA Grants as a % of GDP	-0.01442	<.0001
ODA Loans as a % of GDP	0.004359	<.0001
Agriculture Output as a % GDP	-0.22373	<.0001
GDP per capita	-0.10983	0.0201

To examine if there are differences in the determinants of tax revenue according to the income level of a country, the sample of 59 countries was split into low- and lower-middle-income countries (GDP per capita of no more than $3 975 in 2010) and upper-middle-income countries (GDP per capita of no more than $12 275 in 2010).The results are reported in Table 12 and indicate that difference in coefficient estimates in the different income country groups. As a caveat it must be noted that the upper-middle-income group had a much smaller sample of 17 countries and as such the validity and therefore inference from model results must be viewed with some level of precaution. There are significant differences in aid variable regressors: for low- and lower-middle-income aid grants are significantly negative but loans are positive and

insignificant; whilst for upper-middle-income countries loan and grant aid are both positive and statistically insignificant. The aid grant coefficient for low – and lower-middle-income countries appears to be similar to the results in the main regression analysis results, with a 1% increase in grant aid leading to a decrease in tax revenue by .01%. Contrary to study expectations, the coefficient for agriculture output which is significant for both income groups suggest that increase in agricultural sector would result in a larger magnitude reduction in tax revenues as countries became relatively richer. This is to say, a 1% increase in agricultural output in upper-middle-income countries led to a .75% decrease in tax revenue in contrast to reduction in revenue of 0.24% in low-lower-middle-income countries.

Table 12: Fiscal Response sub Analysis (by income group) Results (1996-2010)

	Upper-Middle Income Countries		Low- and Lower-middle-income countries	
Variable	**Estimate**	**p value**	**Estimate**	**p value**
Industry Output as a % of GDP	0.257338	0.6696	0.057127	0.2348
Imports as a % of GDP	0.340871	0.1610	0.174874	0.0045
Exports as a % of GDP	0.24344	0.3943	0.096669	0.1449
ODA Grants as a % of GDP	0.031607	0.2562	-0.01233	0.0006
ODA Loans as a % of GDP	0.002786	0.6617	0.001009	0.5577
Agriculture Output as a % GDP	-0.75358	0.0351	-0.23737	<.0001
GDP per capita	0.297382	0.8488	0.21077	0.1609
Number of Countries	17		42	

4.5 Discussion

This study has shown agriculture remains an important economic sector in many low- and middle-income countries. Nearly 40% of economic output in low-income countries is derived from the agriculture sector, roughly double the average in lower-middle-income countries and four times higher than the average in upper-middle-income countries. However, despite the importance of agriculture in these economies, the share of government expenditure on agriculture has decreased over time. To help understand why this trend is occurring, this study has explored factors that affect the share of government expenditure committed to agriculture.

Several factors appear to be involved, including the fungibility of this aid and its impact on tax revenues.

For example, the declining share of agriculture in total government spending appears to signal a shift in government priorities in some economies towards other sectors such as transport, communication and education. This trend is likely to be most prominent for the wealthier subset of developing countries that are transitioning away from an agriculture-based economy toward a more industrial-based economy. We have found evidence of this shift in our sample of upper-middle-income countries, where agricultural output decreased and industrial output increased over time. Despite this shift, many low- and middle-income countries remain large recipients of ODA. In fact ODA to the agriculture sector has increased in recent years, especially since the recent world food crisis. The increase in agricultural aid and concomitant decline in the share of government expenditure on agriculture is interesting because it may indicate that agricultural aid is fungible. Indeed previous studies that have shown ministries of agriculture often do not increase public expenditures by the full amount of inflows of aid to the sector (Seifa Gebrehanna, 2007). Our analysis supports this finding and indicates that aid to agriculture is partially fungible. Specifically, a 1% increase in aid to agriculture led to a less than proportionate increase in public expenditures of 0.03%. From the perspective of the donor community, this suggests that to increase government expenditure in agriculture by $1, donors would need to provide a minimum of $1.97 of development assistance.

The observed fungibility was even more pronounced in low-income countries, in which 0.99 cents of each of aid dollar was treated as fungible, suggesting that if donors wanted to increase public expenditure by $1 they would need to commit $1.99 dollars of aid. Thus, initiatives such the “L’Aquila Food Security Initiative” (AFSI), where G8 leaders agreed to pledge $22 billion in agricultural aid over three years for the world’s poorest countries, would actually require a minimum of $43.78 billion to ensure $22 billion would be successfully channelled through ministries and spent on agriculture. This level of fungibility would undoubtedly undermine efforts to provide additional funding to develop the sector and raise living standards of citizens reliant on income from agriculture.

A common view among development scholars and the international donor community is that fungibility is symptomatic of poor institutional quality in recipient governments. Development finance institutions such as the World Bank have echoed this sentiment and called for greater

selectivity in the allocation of aid, emphasizing that aid be committed to countries that exhibit good governance, as these countries would be more likely use aid for its intended purposes (World Bank, 1998). However, this study found that there was no difference in fungibility when we stratified our sample into groups defined by quality of governance. Though our results for poorly governed countries (those with governance scores below the 50th percentile) were not statistically significant, this finding is consistent with Pettersson (2007) who has also studied the influence of institutional quality on levels of fungibility, albeit for total aid rather than agricultural aid. It is unclear then whether fungibility of agricultural aid is a sign of malicious intent or a phenomenon unique to economies with poor governance. Using quality of governance as a yardstick to decide which countries receive aid is therefore problematic, as this may not be a reliable measure of fungibility or the productivity of fungible funds.

Although this study did not explore how fungible funds were used or their productivity, it appears donor and recipient views often differ on matters concerning the need, best use and management of agricultural aid. For example, the fungibility of agricultural aid may indicate a divergence in funding preferences between recipient governments and donors, suggesting donor priorities no longer align with the needs of recipient governments. This was illustrated in a recent study of AFSI donors (ActionAid, 2012) which showed that only 17% of total agricultural aid was directed toward the top 25 countries with the highest levels of chronic hunger and food insecurity. It may be understandable then that countries without a pressing need for agricultural aid choose to redirect the additional revenue toward other priority sectors. This phenomenon is taking place in upper-middle-income countries which remain large recipients of agricultural aid but are shifting away from an agriculture-based economy.

Another reason for the fungibility of aid may stem from the cross-cutting nature of some ODA. For example, aid that is targeted towards rural development or emergency food relief may not be considered agricultural aid by donors, but governments may see such funds as overlapping and supplementing agricultural aid, leading them to treat aid to agriculture as fungible. Although these excluded items may not directly contribute toward agricultural development, they do so indirectly by supporting the livelihood farmers in low-income and middle-income who live predominately in rural areas and will benefit from improved rural infrastructure such as roads to access markets, or food aid when crops fail. Expanding the definition of agricultural aid to include rural development and food aid would lead to substantial increases in aid to agriculture, from $4.8 billion in to $12 billion in 2007 alone (DAC, 2010). Given these

similarities, it seems cash constrained governments receiving rural development aid and food assistance may therefore use a portion of official aid to agriculture as fungible and divert it toward other uses.

A third explanation for the observed fungibility considers both the ability of the recipient public ministry to manage aid inflows and of donors to monitor aid disbursed. Previous studies have suggested that as the proportion of aid in public expenditure rises, donors monitor the spending of aid more carefully and fungibility decreases (Pack & Pack, 1990, 1993). Our findings do not support this conclusion however. We saw fungibility is highest in low-income countries and that as the share of aid to agriculture increases so to do the levels of fungibility in the sector. Since this aid was disbursed from a numerous donors, it appears that a lack of coordination among donors may be reducing the monitoring of funds, making it easier for ministries of agriculture to divert incoming aid to other sectors. We also found the composition of aid to agriculture has shifted away from support for policy and administrative management. Without this support, ministries may lack the institutional and managerial capacity needed to scale-up the activities required to absorb large inflows of aid. To reduce the diversion of agricultural aid, it seems donors should renew their support for strengthening the institutional capacity of agricultural ministries and focus more resources on coordination and monitoring activities with other donors.

In addition to our analysis of fungibility, to understand why the share of government expenditure on agriculture has decreased over time we also explored the role of aid and its impact on tax revenue. Aid may distort incentives for governments to raise taxes, and this can indirectly affect public expenditures, particularly in hard to tax sectors which rely on tax revenue collected from other sources. Agriculture appears to be one of these hard to tax sectors, as we found a significant negative relationship between agricultural output and tax revenue, such that a 1% increase in agricultural output led to a decrease in tax revenue of 0.30%. This may be due to the often non-commercial nature of agriculture in many low- and middle-income countries, though one would expect tax revenues to increase as commercial farming expands. The results of our fiscal response study suggest aid may indeed distort incentives for governments to raise taxes, as we found evidence of a significant negative relationship between total aid and tax revenue effort. These findings are similar to previous estimates (Gupta et al., 2003) and show that a 1% increase in total aid led to a 0.01% decrease in tax revenue. However, the composition of aid shows us that ODA loans increase domestic resource mobilisation while

ODA grants resulted in a reduction in tax revenues. Since most ODA is given as grants, this explains the overall negative relationship between agricultural aid and tax revenue. These findings are in line with those of previous studies (Mcgillivray & Morrissey, 2001; Gupta et al., 2003; Clist & Morrissey, 2011) which have also found that grants decrease tax revenue. However, the observed magnitude (coefficient) of the impact of ODA grant and loans on tax revenue differed from previous research, most probably due to the use of different data sources and sample sizes.

Another impact of ODA grants on tax revenues may be that they reinforce the aid dependency cycle. In other words, if grants inadvertently distort incentives to increase tax revenue, this could lead to chronic public underinvestment in agriculture and aid recipients struggling to wean off of aid funding. This dependence on aid may account for the decrease in agricultural expenditure that we have observed over time. However, dependence on aid is not a sustainable source of revenue, as aid flows can be erratic over time as donor priorities shift. It is clear then that donors need to not only concern themselves with aid fungibility but also the fiscal effects of aid in general. If aid can distort government incentives and reduce resource mobilisation efforts then it may undermine donor efforts to ensure that aid is indeed 'additive' and helps to increase public expenditure. As much as it is important for donors to monitor incentives of recipients, it is equally important for donors to steer away from irresponsible funding habits. Recent 'big aid push' initiatives that advocate for increased aid volumes has led to a massive influx of foreign aid through the emergence of both 'loan pushing' and 'grant pushing', whereby development finance institutions lend and provide grants even in cases where it inappropriate (Harford & Klein, 2005). For example, in a bid to meet aid volume targets development agencies have been found disbursing loans to already heavily indebted, cash constrained low-income countries with a small tax base and little capacity to pay back loans. Similarly, in a bid to appear to make progress toward international aid targets (i.e. many advanced economies aim to disburse 0.7% of GNI as aid), donors have been able to count commercial loans as aid. According to the Centre for Global Development (CGD), donors such as Japan, Germany and France have been able to profit from disbursing $9 billion in loans (counted as aid) raised at low interest rates to recipient countries at higher market rates (Roodman, 2014). Thus, the structuring of development finance suggests donors may have a part to play in recipients' poor fiscal response to aid.

Taken together, our study findings indicate that the observed reduction in public expenditure to agriculture is due to the impact of aid at both a sectoral and central government level. Firstly, at the ministerial level, aid to the sector is treated as fungible, whilst at the national level total aid received displaces tax effort and may therefore reduce recurrent revenue flowing to the agriculture sector. Weak management of public expenditure in recipient countries may be partly to blame for this, as well as the actions of donors. It appears that donors and recipients often operate in silos, each with their own ideas as to the need, purpose and the expectations of aid and its objectives. For donors, measuring the effectiveness of aid should extend beyond the ambit of just looking at how much and under what ministerial line item aid is used. Instead, donors need to ensure aid is aligned with existing needs, that the receiving ministry has the institutional capacity to absorb aid, and they need to monitor both the development as well as the fiscal response of aid. In order to do this, donors need to work with recipients to understand country needs and the fiscal environment of the receiving government. This may alert donors to the potential for aid to service debt, consumption or non-development expenditures. Fortunately, recent initiatives such as the Paris Declaration for Aid Effectiveness (2005) and related high level forums in Accra (2008) and Busan (2011) have advocated for inclusive partnerships in which aid recipients have wider participation in setting development policies and aid effectiveness is measured using output and impact indicators.

To address the widespread underinvestment in agriculture, we recommend that new innovative development finance models be employed. This would be particularly useful in agriculture as the sector is often viewed as high risk by investors (i.e. lack of enabling infrastructure such as quality road networks and supporting infrastructure), making it difficult to attract private sector participants. The health sector offers illustrative examples, as it has managed to successfully employ new financing models with the participation of the public, development and private sectors. For example, the International Finance Facility for Immunization (IFFI) has risen over $1 billion dollars from long-term capital markets to fund immunization programmes in 70 countries. Similarly, Advance Market Commitments (AMC) have attracted private participation into vaccine research by guaranteeing the price of vaccines once developed (I-8 Group, 2012). Even if grants and loans are still to be used, tweaking how they are structured can ensure public expenditures are maximised and distortive fiscal effects are minimised. Harford & Klein (2005) suggest that a hybrid of loans and grants can be used in which aid can consist of a grant component with an option for recipients to borrow additional funds at market rate, allowing them to borrow an amount that they can afford. Loans could also be provided

and over time be converted to grants provided certain predetermined development outcomes are met. These innovative funding tools offer the chance to encourage public expenditure in agriculture, ensuring the risks and rewards of investing in agriculture are jointly owned and shared by public, private and development partners.

5 RESEARCH CONCLUSIONS

The agriculture sector in developing countries is often subject to market failures and inefficiencies that make it dependent on public-sector investment. Yet agricultural output and public spending on agriculture is in decline. This is despite large inflows of aid at both at the sectoral and national levels. To understand why these trends are occurring, we examined factors that affect the share of government spending on agriculture.

Firstly, we undertook a fungibility study of 63 countries using time series data (1996-2010) to ascertain the impact of agricultural aid on public expenditure to agriculture. We found high levels of fungibility, with agricultural aid in low-and middle-income countries being partially fungible. However, our sub-analysis revealed that fungibility of agricultural aid may not indicate malicious intent of recipient governments as countries with good governance were also found to treat agricultural aid as fungible. Given these findings, we argue against policy recommendations that advocate for donors to avoid providing aid to countries or sectors that treat aid as fungible. Instead, we suggest fungibility of agricultural aid signals that there are differences in the priorities of donors and recipients and the policy focus should rather be on understanding and aligning these opposing views.

Secondly, our fiscal response study investigated the impact of total aid on tax effort for 59 countries in which the agriculture sector was a significant contributor to GDP. We found total aid displaced tax efforts, and that the incentives of recipient governments may be distorted by the composition of aid, with ODA grants leading to decreases in tax revenues and ODA loans having the opposite effect. Since most aid is disbursed as ODA grants, donors may be inadvertently contributing to aid dependency as these inflows result in reduced resource mobilisation. These results are concerning because aid is an unsustainable source of income, yet it may be contributing to decreases in recurrent spending by governments and even further under investment in the agriculture sector.

Given the results of our fungibility and fiscal response studies, it seems donors and governments should focus on making the agriculture sector a more conducive environment for private investors. In other words, they should rather target the root causes of why public and donor funding is needed in the first place. It is worth considering the potential of innovative financing mechanisms to overcome market failures that lead to reduced private investment. This can be

done by government and donors jointly sharing in the risks needed to ensure that private investors are able to lower their risks and costs of capital formation. This would ensure that the agriculture sector is no longer at the mercy of donor and public funding preferences which shift over time and rarely align. There needs to be a greater focus on making sure the sector moves toward commercial sustainability and away from substance smallholder farming.

1 RECOMMENDATIONS FOR FUTURE RESEARCH

Based on the findings of our fiscal response and fungibility studies, we believe that there is still room for further research. First, our studies looked at the impact of aid over a relatively short time period (15 years), and time series data were often missing for individual countries. Since aid may have long-term effects on fiscal aggregates, it would be worth repeating this analysis with panel data that covers a longer period of time and uses multiple imputation to deal with missing data. Secondly, it would be worth exploring the fiscal response of aid at the sectoral level as our study was restricted to the national level. This could be done to explore whether aid crowds out borrowing or tax revenue efforts at the ministerial level in the agriculture sector. Lastly, since our analysis relied on DAC definitions of agricultural aid, research could be undertaken to understand the impact of all aid flows that may fall under the umbrella of agricultural development (including rural development) and check if the same levels of fungibility of agricultural aid are observed.

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APPENDICES

Appendix A: *OECD Functional Classification of Expenditures for Agriculture*

AGRICULTURE, FORESTRY. FISHING AND HUNTING	
(i)Agriculture	- Administration of agricultural affairs and services; conservation, reclamation, or expansion of arable land; agrarian reform and land settlement; supervision and regulation of the agricultural industry - Construction or operation of flood control, irrigation, and drainage systems, including grants, loans, or subsidies for such works - Operation or support of programs or schemes to stabilize or improve farm prices and farm incomes; operation or support of extension services or veterinary services to farmers, pest control services, crop inspection services, and crop grading services - Production and dissemination of general information, technical documentation, and statistics on agricultural affairs and services - Compensation, grants, loans, or subsidies to farmers in connection with agricultural activities, including payments for restricting or encouraging output of a particular crop or for allowing land to remain uncultivated
(ii) Forestry	- Administration of forestry affairs and services; conservation, extension, and rationalized exploitation of forest reserves; supervision and regulation of forest operations and issuance of tree-felling licenses - Operation or support of reforestation work, pest and disease control, forest fire-fighting and fire-prevention services, and extension services to forest operators - Production and dissemination of general information, technical documentation, and statistics on forestry affairs and services - Grants, loans, or subsidies to support commercial forest activities
(iii) Fishing and Hunting	- Administration of fishing and hunting affairs and services; protection, propagation, and rationalized exploitation of fish and wildlife stocks; supervision and regulation of freshwater fishing, coastal fishing, ocean fishing, fish farming, wildlife hunting, and issuance of fishing and hunting licenses - Operation or support of fish hatcheries, extension services, stocking, or culling activities - Production and dissemination of general information, technical documentation, and statistics on fishing and hunting affairs and services - Grants, loans, or subsidies to support commercial fishing and hunting activities, including the construction or operation of fish hatcheries

Appendix B: *CRS Codes included in the DAC definition of agricultural aid*

DAC 5 CODE	CRS CODE	DESCRIPTION	NOTES ON COVERAGE
311	**AGRICULTURE**		
	31110	Agricultural policy and administrative management	Agricultural sector policy, planning and programmes; aid to agricultural ministries; institution capacity building and advice; unspecified agriculture.
	31120	Agricultural development	Integrated projects; farm development.
	31130	Agricultural land resources	Including soil degradation control; soil improvement; drainage of water logged areas; soil desalination; agricultural land surveys; land reclamation; erosion control, desertification control.
	31140	Agricultural water resources	Irrigation, reservoirs, hydraulic structures, ground water exploitation for agricultural use.
	31150	Agricultural inputs	Supply of seeds, fertilizers, agricultural machinery/equipment.
	31161	Food crop production	Including grains (wheat, rice, barley, maize, rye, oats, millet, sorghum); horticulture; vegetables; fruit and berries; other annual and perennial crops. [Use code 32161 for agro-industries.]
	31162	Industrial crops/export crops	Including sugar; coffee, cocoa, tea; oil seeds, nuts, kernels; fibre crops; tobacco; rubber. [Use code 32161 for agro-industries.]
	31163	Livestock	Animal husbandry; animal feed aid.
	31164	Agrarian reform	Including agricultural sector adjustment.
	31165	Agricultural alternative development	Projects to reduce illicit drug cultivation through other agricultural marketing and production opportunities (see code 43050 for non-agricultural alternative development).
	31166	Agricultural extension	Non-formal training in agriculture.
	31181	Agricultural education/training	
	31182	Agricultural research	Plant breeding, physiology, genetic resources, ecology, taxonomy, disease control, agricultural bio-technology; including livestock research (animal health, breeding and genetics, nutrition, physiology).
	31191	Agricultural services	Marketing policies & organisation; storage and transportation, creation of strategic reserves.
	31192	Plant and post-harvest protection and pest control	Including integrated plant protection, biological plant protection activities, supply and management of agrochemicals, supply of pesticides, plant protection policy and legislation.
	31193	Agricultural financial services	Financial intermediaries for the agricultural sector including credit schemes; crop insurance.
	31194	Agricultural co-operatives	Including farmers' organisations.
	31195	Livestock/veterinary services	Animal health and management, genetic resources, feed resources.
312	**FORESTRY**		

DAC 5 CODE	CRS CODE	DESCRIPTION	NOTES ON COVERAGE
	31210	Forestry policy and administrative management	Forestry sector policy, planning and programmes; institution capacity building and advice; forest surveys; unspecified forestry and agro-forestry activities.
	31220	Forestry development	Afforestation for industrial and rural consumption; exploitation and utilisation; erosion control, desertification control; integrated forestry projects.
	31261	Fuelwood/charcoal	Forestry development whose primary purpose is production of fuelwood and charcoal.
	31281	Forestry education/training	
	31282	Forestry research	Including artificial regeneration, genetic improvement, production methods, fertilizer, harvesting.
	31291	Forestry services	
313	**FISHING**		
	31310	Fishing policy and administrative management	Fishing sector policy, planning and programmes; institution capacity building and advice; ocean and coastal fishing; marine and freshwater fish surveys and prospecting; fishing boats/equipment; unspecified fishing activities.
	31320	Fishery development	Exploitation and utilisation of fisheries; fish stock protection; aquaculture; integrated fishery projects.
	31381	Fishery education/training	
	31382	Fishery research	Pilot fish culture; marine/freshwater biological research.
	31391	Fishery services	Fishing harbours; fish markets; fishery transport and cold storage.

Source: OECD DAC Statistics

Appendix C: *List of Countries included in the sample*

EAP *(East Asia and Pacific)*	**ECA** *(East and Central Asia)*	**LAC** *(Latin America and Caribbean)*	**SOUTH ASIA**	**SSA** *(Sub Saharan Africa)*	**MENA** *(Middle East and North Africa)*
China	Albania	Argentina	Afghanistan	Angola	Algeria
Fiji	Belarus	Bolivia	Bangladesh	Benin	Egypt
Indonesia	Georgia	Colombia	Bhutan	Burkina Faso	Morocco
Malaysia	Kyrgyzstan	Costa Rica	India	Burundi	Tunisia
Mongolia	Republic of Moldova	Ecuador	Nepal	Cape Verde	Turkey
Philippines	Serbia	El Salvador	Pakistan	Central African Republic	
Thailand	Ukraine	Guatemala	Sri Lanka	Cote d'Ivoire	
Tonga		Peru		Ethiopia	
Vanuatu		Saint Vincent and the Grenadines		Ghana	
Vietnam				Kenya	
				Lesotho	
				Liberia	
				Malawi	
				Mali	
				Mozambique	
				Namibia	
				Niger	
				Nigeria	
				Rwanda	
				Senegal	
				Sierra Leone	
				Sudan	
				Swaziland	
				Tanzania	
				Togo	
				Uganda	
				Zambia	
				Zimbabwe	

Appendix D: *Breakdown of Agricultural Aid Expenditures*

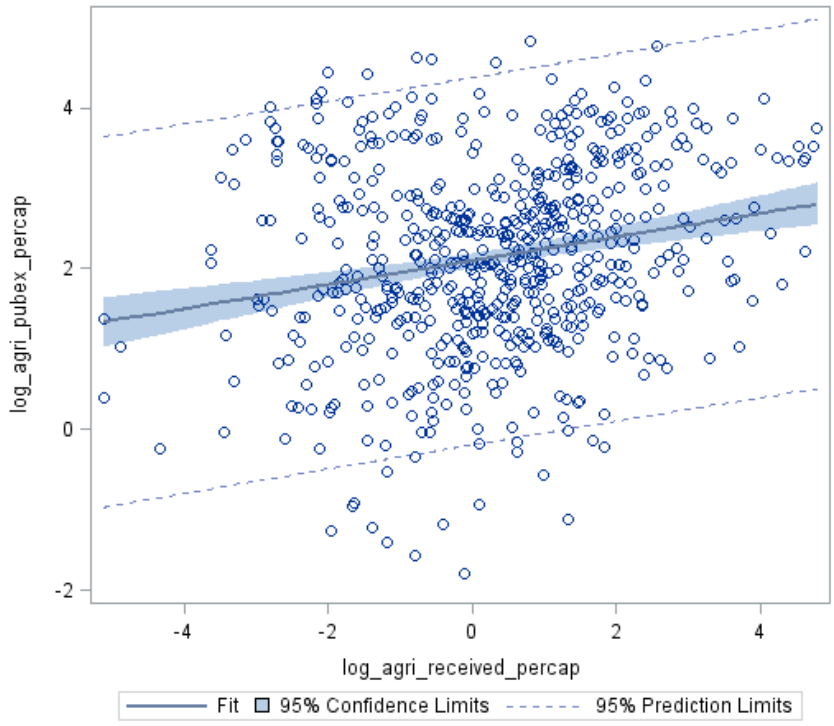
Purpose	1996-1998	1999-2001	2002-2004	2005-2007	2008-2010
Agrarian reform	3%	1%	1%	2%	0%
Agricultural alternative development	1%	0%	9%	11%	7%
Agricultural co-operatives	0%	0%	1%	1%	1%
Agricultural development	8%	11%	13%	12%	22%
Agricultural education/training	1%	1%	1%	1%	1%
Agricultural extension	0%	1%	1%	2%	1%
Agricultural financial services	5%	1%	2%	1%	2%
Agricultural inputs	10%	7%	4%	3%	2%
Agricultural land resources	4%	8%	5%	3%	2%
Agricultural policy & admin. mgmt	14%	26%	13%	14%	16%
Agricultural policy and administrative mana	0%	0%	0%	0%	0%
Agricultural research	2%	2%	3%	5%	2%
Agricultural services	1%	1%	2%	0%	2%
Agricultural services, purpose	0%	0%	0%	0%	0%
Agricultural water resources	25%	17%	15%	18%	16%
Agriculture, combination of purposes in Agri	0%	0%	0%	0%	0%
Agriculture, combinations of purposes in Ag	0%	0%	0%	0%	3%
Agriculture, purpose unspecified or does nc	0%	0%	0%	0%	0%
Fishery development	2%	1%	2%	2%	3%
Fishery education/training	1%	0%	0%	0%	0%
Fishery research	1%	0%	0%	0%	0%
Fishery services	1%	1%	2%	1%	1%
Fishing policy and admin. management	1%	1%	1%	2%	1%
Fishing policy and administrative managem	0%	0%	0%	0%	0%
Food crop production	5%	3%	2%	2%	5%
Forestry development	9%	7%	14%	13%	4%
Forestry education/training	0%	0%	0%	0%	0%
Forestry policy & admin. management	2%	4%	4%	2%	4%
Forestry policy and administrative manage	0%	0%	0%	0%	0%
Forestry research	0%	0%	0%	0%	0%
Forestry services	0%	1%	0%	0%	0%
Forestry, purpose unspecified or does not fi	0%	0%	0%	0%	0%
Fuelwood/charcoal	0%	0%	0%	0%	0%
Industrial crops/export crops	2%	1%	1%	2%	2%
Livestock	1%	1%	2%	2%	1%
Livestock/veterinary services	1%	1%	1%	1%	1%
Plant/post-harvest prot. & pest ctrl	0%	0%	0%	0%	0%

Appendix E: *Breakdown of Agricultural Aid by Donor*

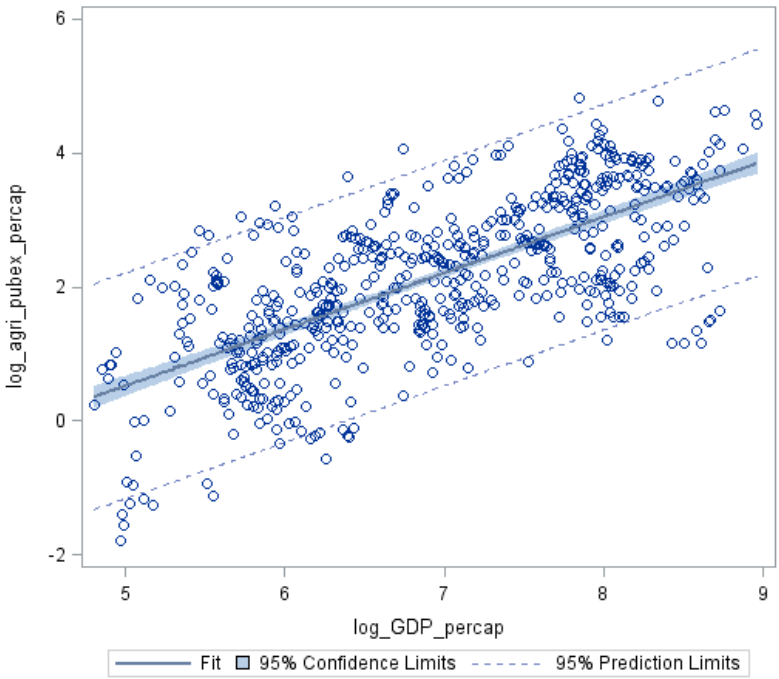
Donor	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
Australia	1.0%	0.4%	0.5%	2.2%	1.7%	2.6%	2.8%	1.7%	0.9%	1.9%	1.7%	0.7%	1.6%	0.8%	3.1%
Austria	0.2%	0.3%	0.4%	0.3%	0.2%	0.1%	0.2%	0.2%	0.2%	0.3%	0.4%	0.2%	0.2%	0.1%	0.3%
Belgium	1.2%	1.3%	1.7%	2.0%	1.8%	1.8%	3.1%	2.4%	2.4%	2.5%	2.2%	2.3%	2.5%	3.1%	3.1%
Canada	1.4%	2.8%	1.7%	0.7%	3.2%	1.3%	1.1%	5.1%	10.1%	3.3%	3.6%	2.1%	6.5%	5.4%	7.6%
Denmark	3.7%	5.2%	2.0%	5.8%	8.4%	1.5%	4.3%	0.3%	5.1%	8.4%	3.7%	2.4%	0.9%	1.8%	1.7%
European Communities (EC)	2.5%	1.1%	3.9%	7.8%	7.1%	4.5%	2.2%	5.3%	10.6%	3.5%	8.8%	5.5%	9.1%	12.2%	13.7%
Finland	0.4%	0.5%	1.0%	0.4%	0.1%	1.0%	0.4%	0.4%	1.6%	1.2%	0.9%	0.9%	1.4%	1.3%	1.8%
France	2.1%	4.3%	6.3%	4.5%	3.3%	7.7%	4.2%	7.6%	5.5%	2.4%	8.8%	11.2%	4.8%	5.5%	4.4%
Germany	8.1%	4.7%	9.9%	8.1%	6.3%	5.4%	7.5%	5.4%	6.5%	5.2%	14.7%	4.9%	4.7%	7.1%	8.4%
Greece	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.1%	0.1%	0.0%
Ireland	0.0%	0.0%	0.0%	0.0%	0.4%	0.4%	0.6%	0.9%	1.1%	0.6%	1.1%	0.8%	1.4%	1.3%	0.9%
Italy	1.0%	0.9%	1.4%	0.9%	1.9%	0.8%	1.7%	1.2%	0.6%	0.3%	1.0%	1.2%	1.5%	0.9%	0.6%
Japan	65.3%	58.3%	44.2%	39.1%	26.6%	51.5%	37.8%	45.6%	15.8%	36.4%	25.7%	27.9%	21.2%	11.5%	13.0%
Korea	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.4%	3.1%	1.0%	0.9%	1.7%
Luxembourg	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.4%	0.7%	0.2%	0.2%	0.3%	0.4%	0.2%	0.2%
Netherlands	3.9%	4.5%	5.7%	3.8%	2.4%	5.4%	6.8%	7.6%	3.8%	4.1%	2.3%	1.5%	1.3%	2.6%	0.6%
New Zealand	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.1%	0.2%	0.2%	0.2%	0.1%	0.1%	0.1%	0.0%
Norway	0.6%	0.6%	0.5%	1.9%	1.9%	0.9%	1.8%	1.6%	2.5%	2.0%	3.1%	1.5%	1.1%	2.8%	1.8%
Portugal	0.0%	0.0%	0.0%	0.1%	0.1%	0.2%	0.1%	0.1%	0.0%	0.0%	0.0%	0.0%	0.0%	0.1%	0.0%
Spain	0.0%	1.7%	2.0%	0.8%	0.9%	2.6%	3.2%	5.1%	2.8%	1.8%	2.4%	2.1%	3.5%	2.1%	2.6%
Sweden	1.0%	3.4%	1.1%	0.8%	0.3%	0.5%	0.2%	0.7%	0.7%	0.7%	3.5%	0.8%	0.2%	1.4%	0.8%
Switzerland	1.4%	1.5%	1.8%	2.0%	2.7%	1.5%	4.4%	1.8%	2.2%	0.9%	0.6%	1.4%	1.1%	0.4%	0.8%
United Kingdom	3.3%	2.7%	8.1%	4.9%	12.7%	1.3%	2.2%	4.6%	2.6%	3.1%	1.0%	1.0%	0.5%	4.1%	0.2%
United Nations Development Programme	0.0%	0.0%	0.0%	1.0%	0.0%	0.0%	0.0%	0.0%	0.5%	0.1%	0.1%	0.0%	0.0%	0.1%	0.0%
United Nations Peacebuilding Fund (UNPBF)	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
United States	2.8%	5.8%	7.8%	13.1%	17.9%	9.2%	15.4%	1.8%	23.7%	20.7%	13.3%	28.0%	35.0%	34.1%	32.5%
WFP	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Appendix F: *Scatter Plot of Fungibility Study of Logged Independent Variables verse Logged Dependent Variable (Agricultural Public Expenditure)*

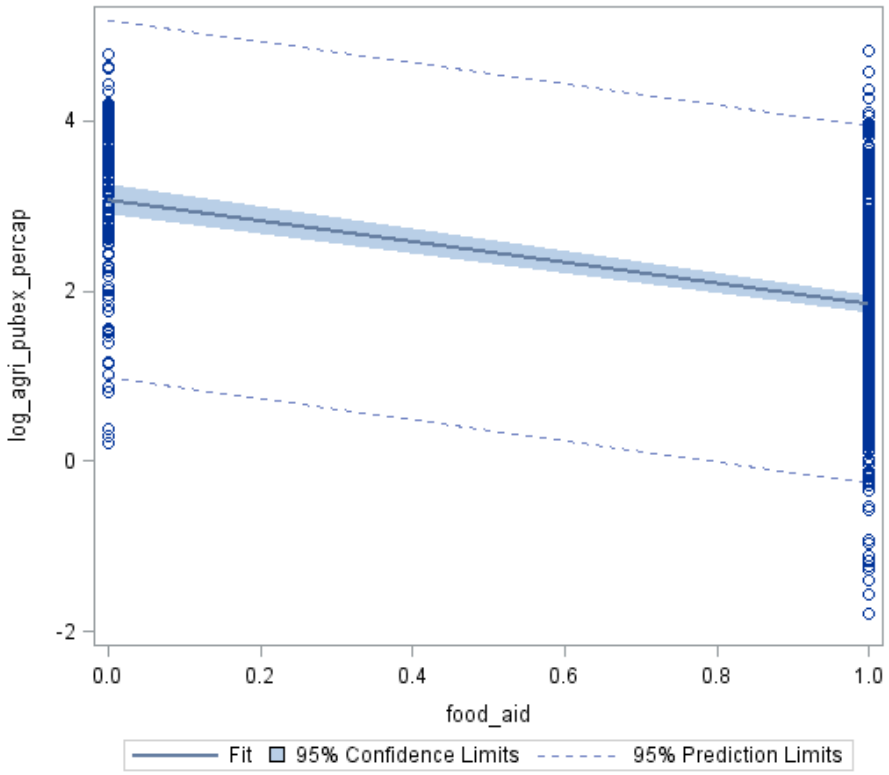
i. Agriculture Aid (log) against Agricultural Public Expenditures (log)



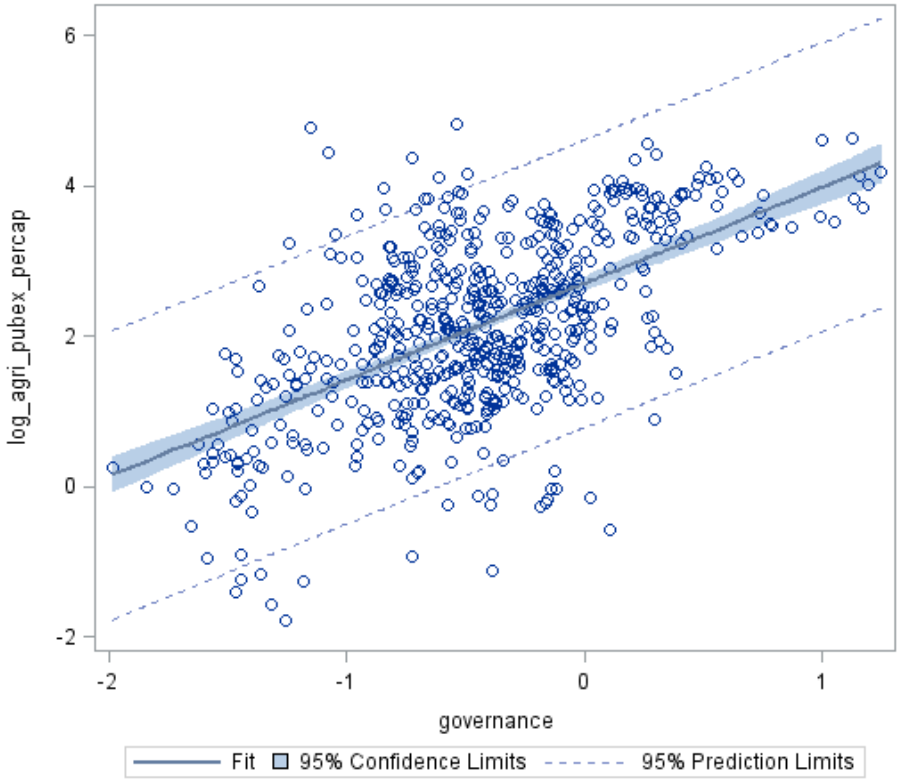
ii. GDP per Capita (log) against Agricultural Public Expenditures (log)



iii. Food Aid Received (log) against Agricultural Public Expenditures (log)

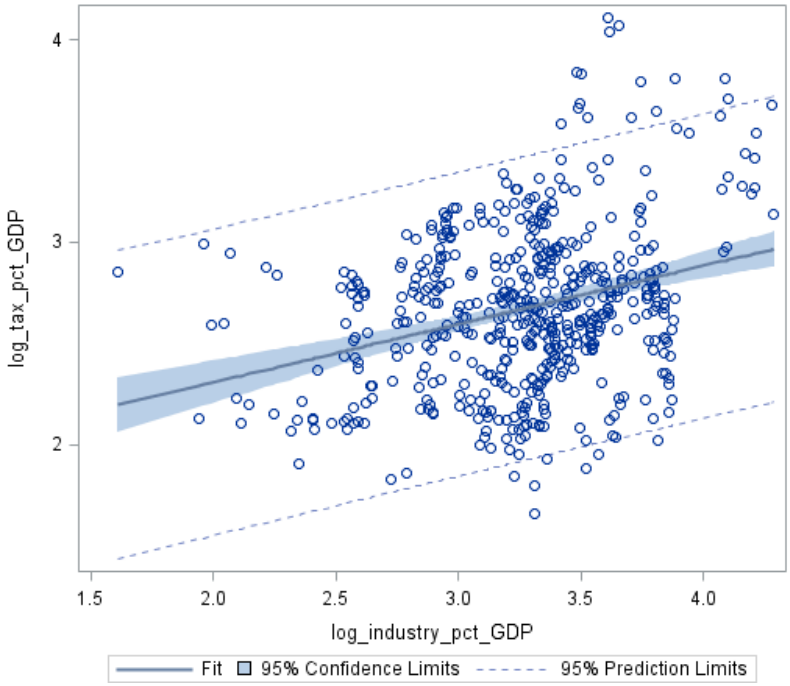


iv. Governance (log) against Agricultural Public Expenditures (log)

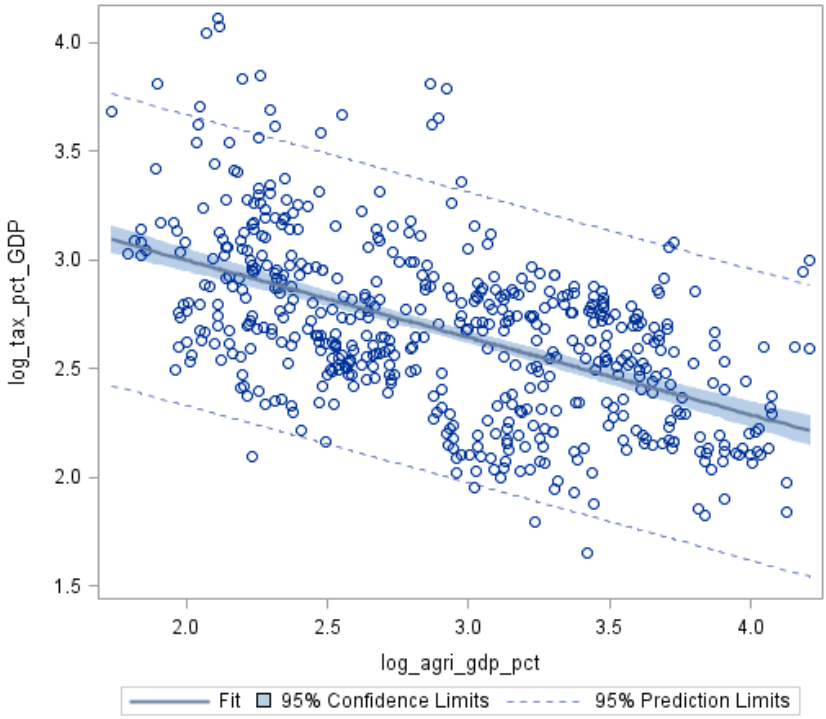


Appendix G: *Scatter Plot of Fiscal Response Study of Logged Independent Variables verse Logged Dependent Variable (Tax Revenue)*

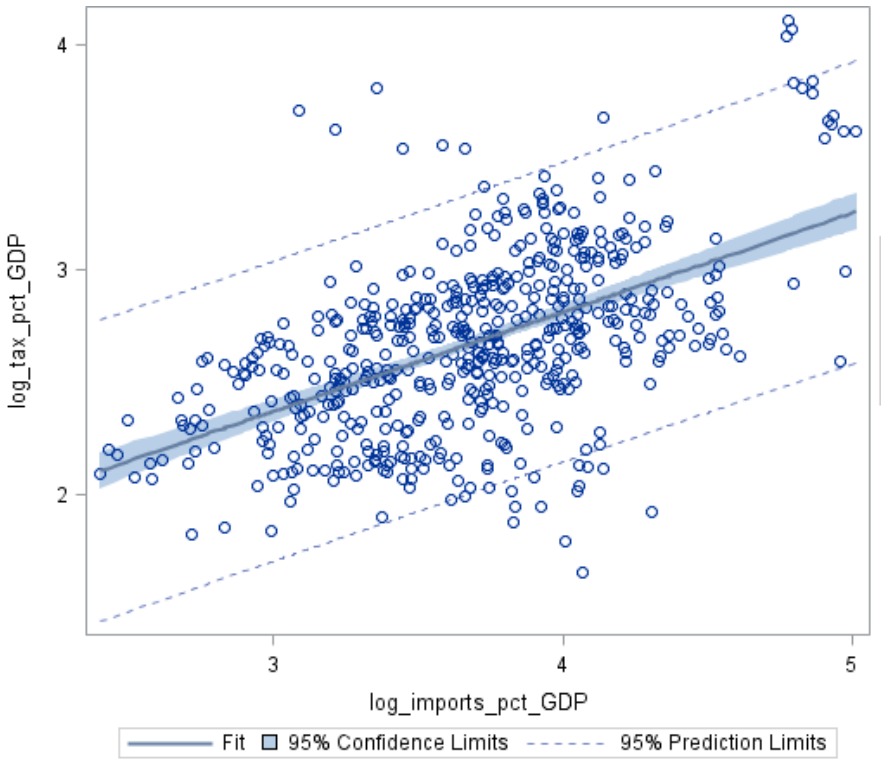
i. **Industry Output as a Percentage of GDP (log) against Tax Revenue as a Percentage of GDP(log)**



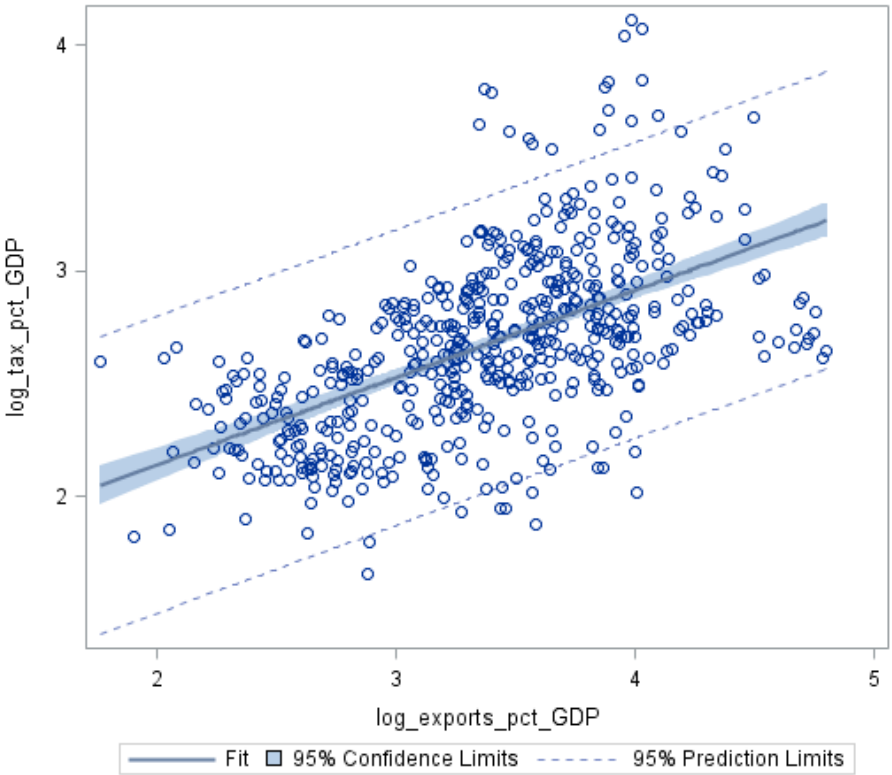
i. **Agricultural Output as a Percentage of GDP (log) against Tax Revenue as a Percentage of GDP(log)**



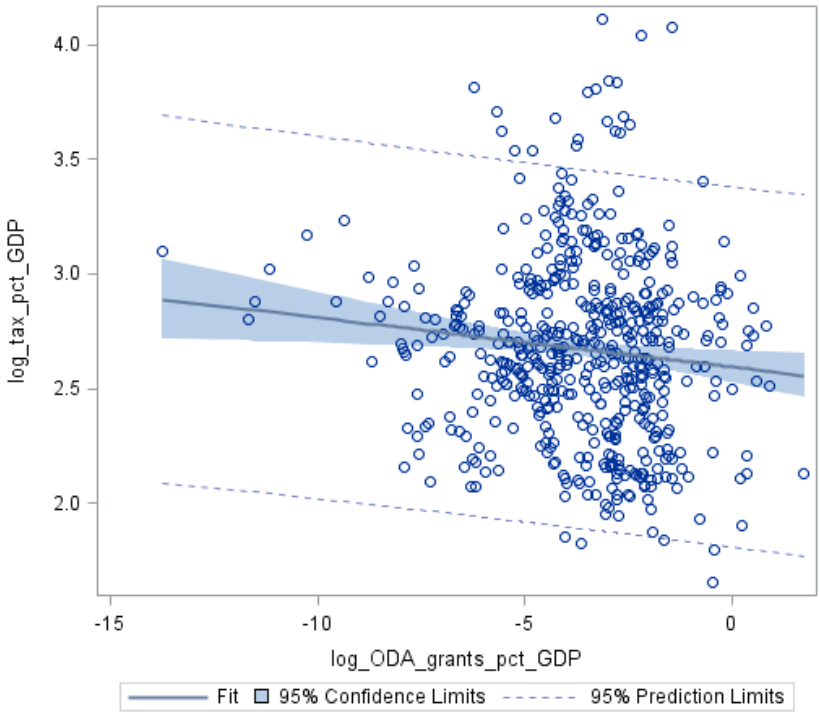
ii. Import Output as a Percentage of GDP (log) against Tax Revenue as a Percentage of GDP(log)



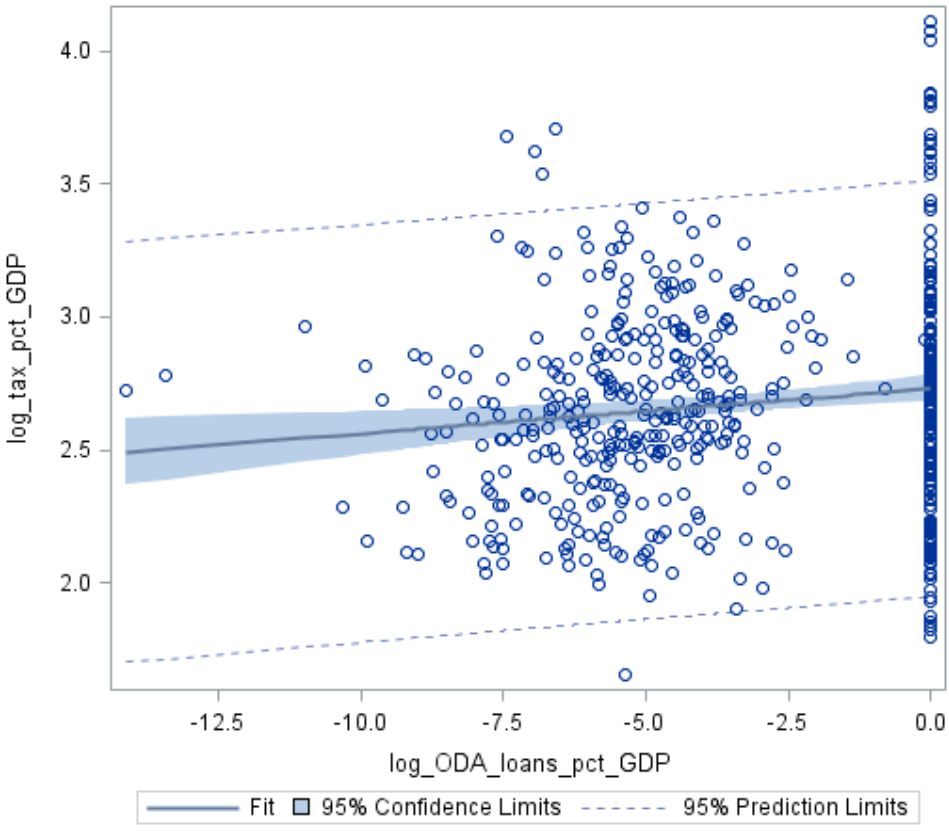
iii. Export Output as a Percentage of GDP (log) against Tax Revenue as a Percentage of GDP(log)



iv. ODA Grant as a Percentage of GDP (log) against Tax Revenue as a Percentage of GDP(log)



v. ODA Loans as a Percentage of GDP (log) against Tax Revenue as a Percentage of GDP(log)



vi. GDP Per Capita (log) against Tax Revenue as a Percentage of GDP(log)